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International Control of Cholera: An Environmental Perspective to Infectious Disease Control

JULIA A. JONES*

"From the time the cholera proclamation was issued, the local garrison shot a cannon from the fortress every quarter hour, day and night, in accordance with the local superstition that gunpowder purified the atmosphere."¹

INTRODUCTION

Cholera has remained a persistent global health problem despite the advent of modern medicine and international health policy. The landmark 1991 outbreak in Peru recently brought cholera to the attention of the world.² With hundreds of thousands of cases in Peru, cholera emerged within only a few months as one of the Western Hemisphere's most important public health problems of the early 1990s.³ As is often the case when cholera infects a previously uncontaminated area such as Peru, microbiologists, clinicians, and public health officials are frequently unprepared. The result can often be delayed or inadequate diagnosis and inappropriate treatment leading to unnecessary morbidity and mortality. In addition, cholera has proven difficult to control. In many parts of the world, cholera has demonstrated resistance to multiple antimicrobial agents and vaccines, complicating both treatment and public health prevention measures.⁴ Cholera's defiance of medical measures reinforces the necessity to control the disease at its source—contaminated water. It is a disease that should be controlled through the environment that gives it life.

The re-emergence of cholera shocked the global community into recognizing the link between disease and environmental conditions as well as appreciating the deficiencies in the provision of water and basic sanitation facilities in many nations. The result has been to evoke efforts to increase research, development, and policy-making in sanitation and drinking water quality.

Cholera is also an inescapable reminder of nations' geographic and environmental interconnection. As states share natural resources, trade interests,

* J.D./M.S.E.S. Candidate, 1999, Indiana University School of Law-Bloomington & School of Public and Environmental Affairs; M.S., 1995, Purdue University; B.A., 1993, Earlham College. I dedicate this Comment to my father, Dr. Robert B. Jones. Also, I would like to thank Professor David P. Fidler for all his assistance.

1. GABRIEL GARCIA MARQUEZ, *LOVE IN THE TIME OF CHOLERA* 111-12 (1988). The quotation reflects the prevailing misperceptions concerning the cause, transmission, and prevention of cholera at the end of the 19th century. The fear and superstition of cholera often lead to inadequate attempts of regulation.

2. See *infra* text accompanying note 44.

3. See *infra* text accompanying notes 44-47; see also R.I. Glass et al., *Epidemic Cholera in the Americas*, 256 *SCI.* 1524, 1524 (1992).

4. See *infra* text accompanying notes 20-23.

and public and environmental health concerns, they also share cholera. Without the option of complete isolation, no one state is invincible from the spread of cholera.

This Comment attempts to analyze international law and reemerging infectious diseases, specifically focusing on cholera. First, it defines both the infectious disease concept and cholera, the disease itself. Second, this Comment evaluates the reasons why cholera remains a threat to the international community. By closely examining the factors that contribute to the spread of cholera, this Comment illustrates the complexities of infectious disease regulation on an international scale. Third, current attempts to control emerging infectious diseases, specifically cholera, are analyzed. Many of these attempts are founded on similar principles with similar goals, and still they prove inadequate to limit the spread of cholera. Finally, recommendations to improve the control of cholera, which can also be applied to infectious disease generally, are provided. These recommendations seek to foster an investigation of alternative means to aid in the international regulation of cholera.

I. CHOLERA: A REEMERGING INFECTIOUS DISEASE

Cholera is a reemerging infectious disease that threatens the global community, yet to understand the extent of its threat, the nature of the disease must be understood. This Part intends to lay the background of cholera. Following a brief introduction to the infectious disease concept, the biology, history, and epidemiology of cholera will be presented.

A. *The Infectious Disease Concept*

Infectious diseases are diseases that spread when one organism transmits a bacterium, virus, parasite, or fungus to another new organism.⁵ Infectious diseases can be transmitted through air, water, direct contact with bodily fluids (for example, blood, saliva, feces, and urine), and intermediary organisms such as insects.⁶ Each newly infected organism then serves as a host and can transmit an infectious disease to other susceptible organisms, thereby increasing the numbers infected.

Public health authorities usually label both emerging and reemerging infectious diseases as ““emerging infectious diseases”” (“EIDs”) and define EIDs as diseases with an ““infectious origin whose incidence in humans has increased within the past two decades or threatens to increase in the near future.””⁷ Included in this definition

5. See David P. Fidler, *Return of the Fourth Horseman: Emerging Infectious Diseases and International Law*, 81 MINN. L. REV. 771, 776-77 (1997); see also, e.g., INSTITUTE OF MED., EMERGING INFECTIONS: MICROBIAL THREATS TO HEALTH IN THE UNITED STATES 41 (1992) (providing, as an example, candidiasis, which is a fungal disease that can affect the gastro-intestinal tract, vagina, and mouth, and which is often associated with AIDS).

6. See, e.g., Bernard N. Fields, *Pathogenesis of Viral Infections*, in EMERGING VIRUSES 69, 70 (Stephen S. Morse ed., 1993).

7. Fidler, *supra* note 5, at 778 (quoting U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION, ADDRESSING EMERGING INFECTIOUS DISEASE THREATS: A PREVENTION STRATEGY FOR THE UNITED STATES 1 (1994)).

are diseases that have reemerged in traditional locations, such as cholera in India, or in new regions, such as cholera in the Western Hemisphere.

B. Cholera Description

Cholera is a reemerging infectious disease caused by the bacterium *Vibrio cholerae* O1 which occurs in both epidemic and endemic forms.⁸ Humans can be afflicted by cholera which causes severe diarrhea and vomiting, and rapidly can lead to dehydration and death if not promptly treated.⁹ However, typically only about two percent of persons infected with cholera manifest life-threatening symptoms. More than ninety percent of cholera episodes are of mild or moderate severity and are difficult to distinguish from other types of acute diarrhea.¹⁰

Cholera is transmitted primarily through ingestion of water contaminated with human feces, including foods that have been washed in contaminated water.¹¹ Transmission of cholera by person-to-person physical contact appears to be extremely rare.¹² Furthermore, chronic human carriers of cholera are uncommon and are not known to play any role in cholera transmission or persistence.¹³ There are no animal reservoirs, but cholera does have environmental reservoirs. It is indigenous to water and is frequently found in both fresh and salt water, as well as estuarine environments.¹⁴ Cholera has a tendency to adhere to the exoskeleton of crabs, shrimp, and other crustaceans, yet it is also found in zooplankton, in mollusks, and in the roots of aquatic plants.¹⁵ As a result of its indigenous reservoir in water, food has become a concern for transmission of cholera. Contamination of foods with *Vibrio cholerae* O1 most often results from direct or indirect contact with the feces of infected persons or water contaminated with fecal matter. Generally, contact occurs in one of the following circumstances: (1) fecally contaminated water for washing or preparing raw foods; (2) ice made from fecally contaminated water; (3) handling of food by infected persons who have failed to wash their hands after contact with feces; and (4) fecally contaminated water used to irrigate fruits and vegetables that grow close to the soil.¹⁶

8. See Paul A. Blake, *Epidemiologic Aspects of Cholera*, in CHOLERA ON THE AMERICAN CONTINENTS 11, 12 (A.F. Pestana de Castro & W.F. Almeida eds., 1993); Jose Martinez et al., *Diarrheal Diseases*, in DISEASE CONTROL PRIORITIES IN DEVELOPING COUNTRIES 91, 99 (Dean T. Jamison et al. eds., 1993).

9. See Blake, *supra* note 8, at 12.

10. See *id.*

11. See *id.* at 15; see also Gunther Craun et al., *Prevention of Waterborne Cholera in the United States*, 83 J. AM. WATER WORKS ASS'N 40, 42 (1991).

12. See Blake, *supra* note 8, at 15.

13. See *id.*

14. See Maria Therezinha Martins, *Water as a Vehicle for Cholera*, in CHOLERA ON THE AMERICAN CONTINENTS, *supra* note 8, at 65.

15. See *id.*

16. See Fernando Quevedo, *Foods and Cholera*, in CHOLERA ON THE AMERICAN CONTINENTS, *supra* note 8, at 71, 74.

Human fatality rates may be as high as fifty percent when cholera strikes a community that has inadequate sanitation treatment facilities.¹⁷ In contrast, a well-developed treatment program for cholera can limit the fatality rate to less than one percent.¹⁸ In most cases of cholera, administering a solution of oral rehydration salts is a successful treatment, or, for more severe cases, intravenous fluids and antibiotics such as tetracycline are used in treatment.¹⁹

Efforts to develop cholera vaccines have spanned eleven decades and have resulted in little success. Public health officials have abandoned vaccines as a method to control cholera because they induce only weak or short-term immunity.²⁰ Data from field trials of oral vaccines administered in Bangladesh demonstrated limited protection of three years for fifty-one percent of those immunized, with children suffering the greatest loss of immuno-protection provided by the vaccine.²¹ Vaccination does not eliminate cholera from the human body, and, therefore, is not likely to prevent transmission of infection since it can still be carried and excreted.²² Recently a new strain of cholera called *Vibrio cholerae* O139 or "Bengal" cholera that is resistant to multiple antibiotics has emerged in Bangladesh and East Africa.²³ Of concern is that the cholera vaccines currently used for *Vibrio cholerae* O1, which have had less than desirable results, will not work against this new strain. Overall, currently available cholera vaccines do not prevent cholera.

C. History and Epidemiology

Throughout history, cholera has remained a persistent international problem. Sanskrit, Arabic, and Chinese writings dating back at least two millennia have been found to contain descriptions of cholera.²⁴ The history of cholera preceding the 1950s is commonly understood as having occurred in a series of pandemics, each originating in India.²⁵ The first cholera pandemic, lasting from 1817 to 1823, surfaced in Calcutta and spread rapidly through India and Asia, yet failed to impact Europe.²⁶ Over the next fifty years, six more cholera pandemics would occur across the world, including Africa and South America.²⁷ As a result of the first pandemic,

17. See World Health Org., *Cholera, Fact Sheet N107, March 1996* (visited March 18, 1999) <<http://www.who.int/inf-fs/en/fact107.html>> [hereinafter *Cholera Fact Sheet*].

18. See *id.*

19. See *id.*

20. See John J. Mekalanos & Jerald C. Sadoff, *Cholera Vaccines: Fighting an Ancient Scourge*, 265 SCI. 1387, 1387 (1994).

21. See *id.* at 1388.

22. See Craun et al., *supra* note 11, at 42.

23. See Martinez et al., *supra* note 8, at 99; Travellers Med. and Vaccination Ctr., Travel Health News, *Cholera Killed 5,000 in Africa Last Year* (visited Jan. 19, 1999) <<http://www.tmcv.com.au/alert2.html>>.

24. See Mekalanos & Sadoff, *supra* note 20, at 1387.

25. See Blake, *supra* note 8, at 13.

26. See GEOFFERY MARKS & WILLIAM K. BEATTY, EPIDEMICS 193-94 (1976).

27. See Paul A. Blake, *Historical Perspectives on Pandemic Cholera*, in *VIBRIO CHOLERAEE AND CHOLERA: MOLECULAR TO GLOBAL PERSPECTIVES* 293, 293 (I. Kay Wachsmuth et al. eds., 1994) (noting that, although historians differ on the exact dates of the pandemics, the most commonly used dates are: pandemic one from 1817 to 1823; pandemic two from 1829 to 1851;

England passed the Quarantine Act of 1825, even though quarantine measures already had proved ineffective in halting the spread of cholera.²⁸ Shortly thereafter, a second pandemic (1826-37) affected all of Europe. This pandemic was not notable for the fatality rate, but rather it was notable for the concentrated public attention on efforts to stop the spread of cholera.²⁹ For instance, the Cholera Prevention Act of 1832 was enacted by England to give the British government a wide range of public health emergency powers.³⁰ Throughout the mid-1800s cholera reemerged three more times on the European continent (1848-49, 1853-54, and in 1866).³¹ The 1866 epidemic was the last cholera epidemic to erupt in England, and its relatively attenuated impact was attributed to the effectiveness of sanitary reform.³² Additionally, by 1900 cholera apparently had also been eliminated from the western hemisphere.³³ The seventh cholera pandemic began in 1961 in the Pacific Islands.³⁴ It then spread rapidly throughout Asia, reaching Bangladesh in 1963, India in 1964, and the USSR, Iran, and Iraq in 1965-66. In 1970 cholera reemerged in Africa where it had been in remission for more than 100 years.³⁵ Then, in 1991 it struck Latin America.³⁶

II. THE GLOBAL THREAT OF CHOLERA

Cholera is a global threat and no simple answer exists to explain why cholera has remained such a significant problem. This Part will begin by explaining the persisting problem of cholera, followed by an examination of why global control of cholera continues to pose such monumental challenges to the development of legal and public health strategies. Within that examination, the most frequently cited factors contributing to cholera will be analyzed. The factors are not discussed in order of importance or priority, nevertheless, those factors that have links to the environment will be emphasized.

A. The Persisting Problem

Cholera is a disease in resurgence that threatens the global community, sparing no nation from its potential reach. With the modern scale of global commerce and travel, cholera outbreaks are a danger to virtually every nation.³⁷ Cholera is most

pandemic three from 1852 to 1859; pandemic four from 1863 to 1879; pandemic five from 1881 to 1896; pandemic six from 1899 to 1923; and pandemic seven from 1961 to current).

28. See Lewis C. Vollmar, Jr., *The Effect of Epidemics on the Development of English Law from the Black Death Through the Industrial Revolution*, 15 J. LEGAL MED. 385, 413 (1994).

29. See *id.*

30. See *id.* at 415.

31. See *id.* at 415-18.

32. See *id.* at 417.

33. See *id.* at 418.

34. See *Cholera Fact Sheet*, *supra* note 17.

35. See *id.*

36. See *infra* text accompanying note 44.

37. See Fidler, *supra* note 5, at 774 (citing the globalization problem to combating the spread of infectious diseases).

threatening to those developing nations where the people are the least protected and the public health community is the least prepared for a cholera outbreak. Medical science has failed to develop an assured method of cholera prevention, but the answer to cholera prevention does not lie within the medical sciences, rather it is found in the environmental sciences. Many developed nations, such as the United States, no longer suffer from cholera because, as a nation, they have engineered and implemented safe sewage and drinking water systems. Unfortunately, not every nation in the world shares the same status of development and the number of recent cholera cases remains astonishing.

As of February 26, 1998, the number of cholera cases reported to the World Health Organization ("WHO") for 1997 totaled 134,565 with 6059 deaths.³⁸ As of April 7, 1998, the cumulative number of 1998 cases of cholera reported, beginning with January 1, 1998, has hit a grand total of 49,226 with 1772 deaths.³⁹ However, the true scale of the global cholera problem is not adequately reflected by these numbers, because they only represent reported cases and not the potential thousands of unreported cases that occur each year.

Currently, numerous eastern and southern African states are afflicted by severe outbreaks of cholera, often with averages of sixty-five new cases per day.⁴⁰ Chad, Mozambique, Democratic Republic of Congo, Somalia, Uganda, and Zambia have all reported recent cholera outbreaks.⁴¹ To illustrate the severity and persisting problem of cholera in these nations, since January 1, 1998, a total of 16,982 cases with a fatality rate of five percent has been reported in Uganda.⁴² Overall, the WHO estimates that seventy-nine million people in Africa are currently at risk of being infected with cholera.⁴³

A recent example of the severity of cholera in the western hemisphere is the outbreak in Peru in 1991. Emerging almost simultaneously in several cities along the coast of Peru, cholera spread rapidly, infiltrating other urban areas and crossing the Andes to reach the headwaters of the Amazon in less than a month.⁴⁴ Cholera spread to contiguous countries and, in less than ten months, it was the scale of an epidemic, spanning a continent. The United States as well as twelve Latin American countries all reported domestically acquired cases of cholera that were believed to be related to the Peruvian outbreak.⁴⁵ The number of reported cases in Peru increased to a staggering 20,000 per week within the first eight weeks of the

38. See World Health Org., *Global Cholera Update* (last modified Apr. 8, 1998) <<http://www.who.int/emc/diseases/cholera/choltbl1997.html>>.

39. See World Health Org., *Communicable Diseases Surveillance and Response (CSR), Cholera in Uganda, Disease Outbreaks Reported, 7 April 1998* (visited Mar. 18, 1999) <http://www.who.int/emc/outbreak_news/n1998/apr/n7apr1998.html>.

40. See *id.*

41. See *id.*

42. See *id.*

43. See George A.O. Alleyne, *Infectious Diseases—A Global Problem* (last modified Jan. 29, 1999) <<http://www.paho.org/english/ops9702.htm>>.

44. See Robert V. Tauxe & Paul A. Blake, *Epidemic Cholera in Latin America*, 267 JAMA 1388, 1388 (1992).

45. See *id.*

epidemic.⁴⁶ By the end of 1991, the total number of cholera cases in Peru was close to 300,000 and another 60,000 cases had been reported by other Latin American countries in the same year.⁴⁷ Although mitigated in 1991, the epidemic did not fully subside. According to the WHO, during January 1998 a total of 2863 cases, with sixteen deaths, had been documented in Peru compared to only 174 cases and one death in the corresponding period of 1997.⁴⁸ These numbers portray the magnitude of the problem and how cholera continues to re-surge.

*B. Why Global Control Is a Problem: Factors
Contributing to Cholera*

There is no one explanation of why cholera has not been conquered by the efforts of modern medical science. Its perpetual re-emergence is a complex phenomenon that encompasses health, environmental, social, political, and economic factors. This Part attempts to address the most significant of these factors.

A critical error in the control of infectious diseases has been the focus on the actual microbe as the foe, combined with a response to seek and destroy it. A more enlightened understanding would embrace an ecological perspective to control the spread of diseases. The spread of cholera is influenced by both naturally occurring environmental phenomena as well as by human alterations to the environment. Scientific research supports the viewpoint that changing the natural environment may create conditions conducive to the re-emergence of infectious diseases.⁴⁹ Human manipulation, invasion, and degradation of the environment can create new vectors for transmission of infectious diseases that did not formerly exist. Scientists have identified Hemorrhagic fever, Lassa fever, Lyme disease, La Crosse Encephalitis, and ehrlichiosis as infectious diseases that have already been identified as having spread following observed environmental changes.⁵⁰

1. Changing Ecosystems and Human Influence

Human activity alters ecosystems that will ultimately affect the spread of infectious diseases. Scientists have identified three general forces that are influenced by human activity and that can influence the extent to which infectious diseases impact humans. These forces include: the change in abundance, virulence,

46. See Eduardo Salazar-Lindo, *Cholera in Peru, 1991: The Extent of the Epidemic, Modes of Transmission, and Lessons Learned*, in CHOLERA ON THE AMERICAN CONTINENTS, *supra* note 8, at 21, 23.

47. See *id.*

48. See World Health Org., *Communicable Diseases Surveillance and Response (CSR)*, *Cholera in Peru, Disease Outbreaks Reported*, 25 Feb. 1998 (visited Mar. 12, 1999) <http://www.who.int/emc/outbreak_news/n1998/feb/n25feb1998.html> [hereinafter *Cholera in Peru*].

49. See Ann Gibbons, *Where Are 'New' Diseases Born?*, 261 SCI. 680, 680-81 (1993) (reporting on two projects which provide evidence that environmental change may lead to the emergence or re-emergence of infectious diseases).

50. See Fidler, *supra* note 5, at 801-02 (citing reports that changes to the environment are associated with outbreaks of infectious diseases).

or transmissibility of microbes; the probability of human exposure to microorganisms; and an increase in human vulnerability to infection and to infections' consequences.⁵¹ Human migration, urbanization, travel, and trade all can influence the probability of human exposure to microorganisms. Furthermore, the abundance, virulence, and transmissibility of infectious diseases can be influenced by human alterations to the environment, with cholera serving as a perfect example.

a. Urbanization

Urbanization taxes natural resources, alters ecosystems, heightens environmental degradation, and increases the risk for rapid spread of infectious diseases.⁵² Urbanization is a function of population growth; as populations increase, so do the number and sizes of cities. Thus, a chain reaction of events occurs. Population growth forces increased urbanization and with increased urbanization comes increased environmental degradation. Population estimates indicate that each year the world's population increases by approximately seventy million people.⁵³ Such numbers indicate that urbanization will continue creating more environmental degradation and stressing water resources. These conditions only serve to augment human susceptibility to cholera.

A fundamental issue of urbanization is urban water quality and sanitation. As mentioned previously, drinking-water quality and sanitation-system adequacy are of critical importance in avoiding water-borne disease outbreaks such as cholera. Cities with inadequate sanitation systems and large populations may, in effect, serve as reservoirs for cholera. As of 1990 nearly 1.3 billion people in the developing world lacked access to clean water and an estimated two billion lived in regions lacking adequate systems for disposing human waste.⁵⁴ Many cities with existing sanitation systems are challenged to maintain drinking-water quality and city sanitation systems. Clearly this is a greater challenge for some developing nations that lack resources needed to maintain existing systems or to build new systems and implement hygiene infrastructures.⁵⁵ Given future population projections, developing nations will continue to face enormous obstacles in meeting urban drinking-water and sanitation needs.

b. Trade and Travel

The volume and ease of international trade and travel presents boundless opportunities for the spread of infectious diseases. Individuals, merchandise and even vehicles of transportation can serve as carriers for disease. The large-scale movements of goods and people around the globe has heightened the concern that infectious diseases will be introduced into areas where they did not previously exist

51. See Mary E. Wilson, *Infectious Diseases: An Ecological Perspective*, 311 BRIT. MED. J. 1681, 1682 (1995).

52. See *id.* at 1681-82; see also Fidler, *supra* note 5, at 807.

53. See INSTITUTE OF MED., *supra* note 5, at 49.

54. See Wilson, *supra* note 51, at 1682 (citing WORLD BANK, WORLD DEVELOPMENT REPORT (1993)).

55. See Fidler, *supra* note 5, at 807.

or reinfect traditional areas more frequently.⁵⁶ Such concern does not go unfounded. One theory proposed for the 1990 cholera outbreak in South America is that a freighter discharged contaminated ballast water originating from China into Peruvian coastal waters.⁵⁷

Throughout history cholera has been associated with trade and travel and has been credited for instigating the early development of health regulations to minimize cholera epidemics in Europe.⁵⁸ As early as 1849, cholera was understood to "follow major routes of commerce, [and] . . . always appear[] first at seaports."⁵⁹ The clear threat of the spread of infectious diseases associated with trade promoted the convening of the first International Sanitary Conference in 1851.⁶⁰ Other international sanitary conferences followed during the nineteenth century marking a significant development in establishing a regulatory regime that restricts the spread of cholera and allows for trade. A primary objective of these conferences was to reduce the burden on trade that excessive measures, such as quarantine regulations, had created.⁶¹ Fear, and not science, had driven nations to adopt trade-damaging, quarantine measures. The International Sanitary Convention of 1903 recognized the inappropriateness of quarantine measures that had historically been used to fight the spread of infectious diseases. Article 11 of the 1903 Convention held that "[n]o merchandise is capable by itself of transmitting plague or cholera. It only becomes dangerous when contaminated by plague or cholera products."⁶² As science continued to reveal the nature of cholera, further steps to properly regulate the disease were made. The International Sanitary Convention of 1926 reads that "the importation of fresh fish, shellfish and vegetables may be prohibited unless they have undergone a treatment calculated to destroy cholera vibrios."⁶³ Additionally, the Sanitary Conference of 1903 marked the beginning of landmark accomplishments in international disease control by initiating a surveillance system based on a process for notification of disease outbreaks and by prohibiting party

56. See Harvard Working Group on New and Resurgent Diseases, *New and Resurgent Diseases, The Failure of Attempted Eradication*, 25 *ECOLOGIST* 21, 24 (1995) [hereinafter Harvard Working Group].

57. See *id.*

58. See DAVID P. FIDLER, *INTERNATIONAL LAW AND INFECTIOUS DISEASES* (forthcoming 1999) (manuscript at 319, on file with author) (noting how trade serves as a contributing factor to infectious disease spread); Wilson, *supra* note 51, at 1682.

59. Warren Winkelstein, Jr., *A New Perspective on John Snow's Communicable Disease Theory*, 142 *AM. J. EPIDEMIOLOGY* S3, S6 (Supp. 1995). Dr. John Snow was the physician to Queen Victoria of England and has been given credit for stopping the second pandemic (1829 to 1851) in London and for proving its connection to drinking water that had been mixed with sewage. See *id. passim*.

60. See N. Howard-Jones, *Origins of International Health Work*, 1 *BRIT. MED. J.* 1032, 1034 (1950).

61. See FIDLER, *supra* note 58 (manuscript at 319).

62. International Sanitary Convention, Dec. 3, 1903, art. 11, 35 Stat. 1770, 1779, 1 Bevans 359, 365.

63. International Sanitary Convention, June 21, 1926, art. 17(b), 45 Stat. 2492, 2560, 2 Bevans 545, 559.

states to engage in excessive measures against a state that notified others of an outbreak.⁶⁴

Despite the advances made by the International Sanitary Conferences and more modern regulations, excessive regulatory measures of infectious diseases have been and are still common.⁶⁵ The ease of the spread of infectious diseases continues to instill fear into public health officials, and with fear often comes excessive measures of trade regulation that often have tremendous economic repercussions. Such fear is genuine as evidenced by the 1991 cholera outbreak in Peru which substantially impacted the Peruvian economy. Peru incurred an estimated loss in trade of \$12.9 billion (U.S.).⁶⁶ As a result of reduced tourism, Peru suffered an estimated \$500 million in losses.⁶⁷ Much of this damage can be attributed to trade damaging public health measures imposed on Peruvian exports by other WHO member states.⁶⁸ For Peru, neither international law on infectious disease control nor international trade law provided sufficient economic protection against the actions taken by fellow WHO member states.⁶⁹

The economic damage incurred by Peru demonstrates the gravity in developing reasonable and disease-specific health regulations. Additionally, it demonstrates the need to restrict the level of response states may take against a disease-afflicted state. Regulations designed to control cholera need to be tailored to the characteristics of cholera, and not to false, nonscientific conclusions. Necessary regulation of an infectious disease is disease specific and depends on the scientific understanding of that disease. Properly constructed regulations will allow for the maximum amount of travel and trade while ensuring safety from the international spread of cholera.

2. Flooding and Wet Weather

Environmental changes can be induced by human activity or purely as a result of natural circumstances. Regardless of the source of change, cholera outbreaks may result. Flooding and severe wet weather are environmental changes that have repeatedly been blamed for cholera outbreaks. Flooding can cause contamination of water systems and create favorable conditions for cholera. A January 1998 report exclaimed that heavy flooding in the Democratic Republic of Congo exacerbated

64. See Fidler, *supra* note 5, at 834.

65. See, e.g., David Fidler, *Cholera, Impact on Commercial Fishing—East Africa (04)* (visited Feb. 16, 1999) <<http://www.healthnet.org/programs/promed-hma/9801/msg00133.html>>; see also *infra* Part IV.D.

66. See Alan W. Randell et al., *FAO Activities in Latin America and the Caribbean to Control the Spread of Cholera*, in *CHOLERA ON THE AMERICAN CONTINENTS*, *supra* note 8, at 87, 96.

67. See Salazar-Lindo, *supra* note 46, at 25.

68. See *Restrictions on Exports from Peru Following the Cholera Epidemic*, GATT Doc. No. C/M/248 (Mar. 12, 1991) (continuing an argument by a Peruvian representative that restriction of Peruvian exports violated General Agreement on Tariffs and Trade ("GATT") rules and WHO recommendations); see also FIDLER, *supra* note 58 (manuscript at 358-59).

69. See FIDLER, *supra* note 58 (manuscript at 335-36) (discussing that GATT, Article XX(b) provides for a sovereign right for a state to adopt and enforce public health measures if such measures are "necessary to protect human, animal, or plant life or health").

a cholera outbreak claiming the lives of thousands of people.⁷⁰ Many of the victims were children.⁷¹ For the last eight years in Zambia, cholera has resurfaced and claimed many lives with every rainy season.⁷² In October of 1997, reports from Zambia claimed that once again heavy rains had brought to its region flooding and cholera.⁷³

Not all flooding is a result of purely natural occurrences. In some ecological situations, flooding is a direct result of human-induced changes to the environment. Clear-cutting of timber in flood sensitive ecosystems can contribute to the frequency and severity of flooding.⁷⁴ Therefore, reduction of clear-cutting may prevent flooding and may reduce the likelihood of associated cholera outbreaks.

As currently understood, El Niño is a naturally occurring phenomenon that has been associated with cholera outbreaks. Many countries in the Americas are experiencing unexpected outbreaks of cholera associated with the extreme weather conditions brought by the arrival of El Niño. In fact, floods and storms attributed to El Niño have been proposed as the cause or at least as a contributing factor for the 1997-98 resurgence of cholera in Peru.⁷⁵ During 1998, Bolivia, Honduras, Ecuador, and Nicaragua all reported cholera outbreaks associated with the effects of El Niño.⁷⁶

3. Climate Change—Global Warming

The health ramifications of global warming may become one of the largest public health challenges for the upcoming century.⁷⁷ For instance, climatic factors may directly influence the re-emergence of infectious diseases. Increases in water surface temperatures and water levels are believed to have the capacity to lead to higher incidents of water-borne infectious diseases such as cholera.⁷⁸ Climatologists have identified upward trends in global temperatures.⁷⁹ Over the past century ocean surface temperatures have risen by an estimated 0.7 degrees Celsius, and now climatologists expect a future temperature increase of 2.0 degrees Celsius by the year 2100.⁸⁰

70. See *Floods Bring Cholera Death to Congo*, ELECTRONIC MAIL & GUARDIAN, Jan. 16, 1998 <<http://www.mg.co.za/mg/news/98jan2/16jan-cholera.html>> (reporting that 231 people died from cholera and over 1235 had been struck with cholera since December 1997).

71. See *id.*

72. See Joseph Chanda, *Wet Conditions, Cholera Alert!*, AFRICANEWS ONLINE, TIMES OF ZAMBIA, Oct. 30, 1997 <http://www.africanews.org/science/stories/19971030_feat5.html>.

73. See *id.*

74. See Zygmunt J.B. Plater, *From the Beginning, A Fundamental Shift of Paradigms: A Theory and Short History of Environmental Law*, 27 LOY. L.A. L. REV. 981, 985 (1994).

75. See *Cholera in Peru*, *supra* note 48.

76. See World Health Org., *Communicable Diseases Surveillance and Response (CSR), Cholera in Latin America and El Nino, Disease Outbreaks Reported*, 31 Mar. 1998 (visited Mar. 18, 1999) <http://www.who.int/emc/outbreak_news/n1998/mar/n31mar1998.html>.

77. See Jonathan A. Patz et al., *Global Climate Change and Emerging Infectious Diseases*, 275 JAMA 217, 217 (1996).

78. See *id.*

79. See *id.* at 218.

80. See *id.* at 220.

Climate changes may have direct effects on the spread of infectious diseases. Climate change will likely impact regional food supplies, human migration patterns, and urbanization which may, in turn, alter human susceptibility to disease. Susceptibility to cholera may be a repercussion of malnutrition caused by global-warming-induced stress on agriculture.⁸¹ Susceptibility to cholera may also ensue from stressed drinking-water resources and sanitation systems caused by mass migration to cooler geographic areas.⁸²

The WHO estimates that climate change could have a major impact on water resources and sanitation. As the world's population continues to grow, availability of fresh water per capita is expected to decline substantially.⁸³ This will decrease the available drinking water, lower the efficiency of local sewerage systems, and may lead to increased concentrations of cholera bacteria in raw water supplies. Reduction in water supplies may necessitate the use of poorer quality water sources.⁸⁴ Ponds and wells, in addition to irrigation and drainage systems, may be altered by climate change.⁸⁵ For instance, hydrological alterations induced by climate changes of any of these systems may result in higher incidences of cholera infections, such as water flow alterations. A climate-induced increase in cholera resulting from a reduction or alteration in water supplies is most likely to occur in developing countries that do not have adequate sanitation systems and drinking-water supplies.

Climate change may alter the global distribution of cholera and may place new populations at risk. For example, algae blooms, also called phytoplankton, grow in aquatic environments and often harbor pathogens such as cholera.⁸⁶ They are triggered by climatic events and are likely to increase in occurrence as a result of global warming.⁸⁷ Global warming can affect algae bloom growth in three distinct ways: (1) algae bloom growth may be augmented by temperature increases in nutrient-replete waters; (2) increased growth of pathogens in algae blooms may result from temperature increases; and (3) the geographic range in which algae blooms occur may expand as a result of temperature increases.⁸⁸

Algae blooms can be affected by natural occurrences that are not so clearly associated with global warming. For instance, in 1987 one species of toxic phytoplankton previously confined to the Gulf of Mexico, traveled north up the East Coast of the United States due to an influx of warm gulf stream water.⁸⁹ This influx of warmer ocean water temperatures may have been the result of El Niño. El Niño, which is known to bring with it an influx of rain, nutrients from land, and warmer

81. *See id.* at 217.

82. *See id.* at 221.

83. *See* WORLD HEALTH ORG., CLIMATE CHANGE AND HUMAN HEALTH 136 (A.J. McMichael et al. eds., 1996).

84. *See id.* at 96.

85. *See id.* at 97.

86. *See* Patz et al., *supra* note 77, at 220.

87. *See id.*

88. *See id.*

89. *See id.* (noting the spread of *Gymnodinium breve* up the East Coast).

sea surface temperatures, is considered to be another climatic event that evokes growth of algae blooms.⁹⁰

Algae blooms can serve as reservoirs for cholera through two mechanisms.⁹¹ One is by the association of cholera to zooplankton. Zooplankton are aquatic organisms that reside in and feed on algae blooms, and they serve as vectors for cholera.⁹² Therefore, cholera should always be a consideration when algae blooms occur. Dormant forms of *Vibrio cholerae* O1 not only have exhibited the capability of prolonged survival, but also have been found to persist on the sheaths and exoskeletons of marine organisms that are associated with algae blooms.⁹³ Under certain nutrient, pH, and temperature conditions, cholera, in this dormant form, can be triggered to cause a cholera epidemic.⁹⁴ Thus, the spread of cholera may be influenced fundamentally by incidents of algae blooms resulting from the discharge of urban effluents consisting of high concentrations of pollutants. The relationship between cholera and algae blooms truly exemplifies the connection between disease and the environment and illustrates the significance of both human-induced and natural disturbances of the coastal ecosystem to the transmission of cholera.

III. CURRENT ATTEMPTS TO CONTROL THE CHOLERA THREAT: INTERNATIONAL LAW AND CHOLERA

Multiple areas of international law and regulation have impacted the global control of cholera. Some facets of international law recognized the need to address cholera decades ago and took action, while others have developed more indirect regulations of cholera epidemics and outbreaks. This Part will survey those areas of international law that have either directly or indirectly impacted the control of cholera including the International Health Regulations, various international organizations' activities, international environmental law, and international trade law. Although all of these areas will be discussed, the greatest emphasis will be given to international environmental law. General sources of international environmental law will be explained followed by an evaluation of the applicability of marine pollution and water pollution laws and regulations to cholera.

A. Multilateral Agreements: International Health Regulations

International law is critical to the control of infectious diseases such as cholera. International law enables states to come to reasonable agreements pertaining to disease control, and subsequently to develop rules and guidelines to reflect these agreements. To date, the WHO has served as the organization that has predominately designed and administered cholera regulations and guidelines. Their

90. See Harvard Working Group, *supra* note 56, at 2027.

91. See *id.*

92. See *id.*

93. See Anwarul Huq et al., *Detection of Vibrio Cholerae O1 in the Aquatic Environment by Fluorescent-Monoclonal Antibody and Culture Methods*, 56 APPLIED ENVTL. MICROBIOLOGY 2370, 2370-71 (1990).

94. See *id.* at 2371.

authority to do so is derived from Article 21 of the World Health Organization Constitution. Article 21 provides the WHO with the authority to create regulations to address “sanitary and quarantine requirements and other procedures designed to prevent the international spread of disease.”⁹⁵ Pursuant to this authority, the World Health Assembly (“WHA”) adopted the International Sanitary Regulations in 1951, which were revised and renamed the International Health Regulations in 1969 and were later amended in 1973.⁹⁶ The International Health Regulations (“IHRs”) replaced what was a piecemeal set of treaties with a comprehensive set of international public health rules designed to control diseases.⁹⁷ Currently, the IHRs are undergoing further revisions and will be presented for WHA approval by the year 2000.⁹⁸

The IHRs have three important elements that deserve recognition. First, the IHRs are binding on all WHO member states.⁹⁹ Second, the IHRs have the purpose to achieve the greatest global protection against the spread of infectious disease, while maintaining minimal interference with world trade and travel.¹⁰⁰ Finally, the IHRs intend to both prevent the spread of infectious diseases from endemic areas and to contain them upon arrival into noninfected areas.¹⁰¹ One method that the IHRs use to achieve this last element is to address public health issues at ports of entry.¹⁰² Article 14, which can be directly applied to cholera, requires airports and seaports to maintain safe drinking water as well as proper methods for disposal of excrement, refuse, and waste water.¹⁰³

The IHRs require a duty of notification for those diseases subject to its regulations.¹⁰⁴ Currently, cholera is one of three diseases subject to the IHRs’s surveillance requirements which mandate that a member state report incidences of cholera to the WHO.¹⁰⁵ Notification of cholera cases is also required if cholera is transferred within a country to a noninfected area.¹⁰⁶ Article 5 requires that for

95. Fidler, *supra* note 5, at 835 (quoting Constitution of the World Health Organization, July 22, 1946, art. 21, 62 Stat. 2679, 2685, 14 U.N.T.S. 185, 192 [hereinafter WHO Const.]).

96. See P.J. DELON, *THE INTERNATIONAL HEALTH REGULATIONS: A PRACTICAL GUIDE* 9 (1975) (discussing the history of the International Health Regulations).

97. See WORLD HEALTH ORG., *INTERNATIONAL HEALTH REGULATIONS* (1969) art. 86, at 38-39 (3d ed. 1983) [hereinafter INT’L HEALTH REGS.] (listing treaties the IHRs replaced).

98. See World Health Org., *Revision of the International Health Regulations: Progress Report, July 1998*, 73 WKLY. EPIDEMIOLOGICAL REC. 233, 234 (1998).

99. See DELON, *supra* note 96, at 9 (citing INTERNATIONAL HEALTH REGULATION, Annexes I & II (2d ed. 1969)); see also WHO Const., *supra* note 95, art. 22, 62 Stat. at 2685, 14 U.N.T.S. at 193. The member states can be exempted by submitting reservations to the IHRs or rejecting the 1973 amendments. Notable member states that have submitted reservations include South Africa, Australia, and Singapore. See DELON, *supra* note 96, at 9.

100. See DELON, *supra* note 96, at 10; see also INT’L HEALTH REGS., *supra* note 97, at 5 forward.

101. See DELON, *supra* note 96, at 10.

102. See *id.*; see also INT’L HEALTH REGS., *supra* note 97, arts. 14-22, at 15-18.

103. See INT’L HEALTH REGS., *supra* note 97, art. 14, at 15.

104. See *id.* arts. 2-5, at 10-11.

105. See *id.* art. 1, at 8 (identifying the diseases subject to the IHRs as cholera, plague, and yellow fever); *id.* arts. 2-5, at 10-11.

106. See *id.* art. 3, at 11.

diseases in which notification is required, supplemental information about "the source and type of the disease, the number of cases and deaths, the conditions affecting the spread of the disease, and the prophylactic measures taken" must be reported.¹⁰⁷ Upon notification, the WHO then provides this information to the health administrations of all member states.¹⁰⁸

In addition to the surveillance and notification requirements, cholera is specifically subject to other sections of the IHRs.¹⁰⁹ Article 62(1) requires that upon discovery of a cholera case on any transportation carrier, the receiving member state may isolate the infected individual for a time period not to exceed the cholera incubation period of five days from the date of disembarkation or may choose to apply surveillance.¹¹⁰ Article 63 imposes restrictions on the bacteriological examination of foodstuffs carried as cargo.¹¹¹ Additionally, the IHRs restrict the severity of measures that a member state can impose on a person infected with cholera. In cases where cholera is suspected, Article 64(1) prohibits submitting any person to rectal swabbing.¹¹² Article 64(2) provides, however, that a person coming from a cholera-infected area and who exhibits symptoms may be required to submit to a stool examination.¹¹³

However, these IHRs that pertain specifically to cholera may enjoy a limited remaining life-span. The WHA in 1995 directed the WHO to undertake the task of revising the IHRs.¹¹⁴ The revision intends to move from a disease-specific reporting system to a syndrome reporting system, which will affect how cholera is handled.¹¹⁵ Yet, the extent to which the revisions will alter the method of handling cholera remains to be seen.

B. International Organizations' Activities

1. World Health Organization

In addition to administering the IHRs, the WHO Global Task Force on Cholera Control developed guidelines for cholera control.¹¹⁶ The guidelines emphasize the prevention of cholera, being prepared for a cholera outbreak, early response to an

107. *Id.* art. 5, at 11.

108. *See id.* art. 11, at 14. "Notification . . . by means of the *Weekly Epidemiological Record* and the automatic telex service discharges [the WHO's] responsibilities for notification under Articles 11 (first sentence)," 20-22, and 85. *Id.* art. 11, at 14 note a (parenthetical in original).

109. *See id.* arts. 50-75, at 26-33 (illustrating that the IHRs have specific provisions for plague, cholera, and yellow fever).

110. *See id.* art. 62(1), at 30.

111. *See id.* art. 63, at 30.

112. *See id.* art. 64(1), at 30.

113. *See id.* art. 64(2), at 30.

114. *See Revision and Updating of the International Health Regulations*, WHA Res. 48.7, 48th World Health Assembly, 12th Plenary Mtg., WHO Doc. WHA/48/1995/REC/1 (1995).

115. *See id.*

116. *See* World Health Org., *Guidelines for Cholera Control* (visited Feb. 17, 1999) <<http://www.who.int/chd/pub/cholera/cholguid.htm>> [hereinafter *Guidelines for Cholera Control*].

outbreak threat, and preventing the spread of an outbreak.¹¹⁷ According to the WHO, cholera can be prevented by ensuring safe water supplies, promoting environmental sanitation, and promoting food safety.¹¹⁸

To discourage use of ineffective methods of cholera control, the WHO guidelines acknowledge that chemoprophylaxis, vaccination, and travel and trade restrictions are incapable of regulating the spread of cholera and should not be heavily relied upon. Chemoprophylaxis (an antibiotic treatment of an entire community) fails to control the spread of cholera because of the time delay in distribution of the drug, possible reinfection after the drug treatment has been completed, and difficulties in achieving community cooperation to take the drug.¹¹⁹ Vaccinations not only are ineffective in some persons who are vaccinated, but also frequently lack the necessary potency to be effective.¹²⁰ Additionally, cholera vaccinations provide only three to six months of protection and do not reduce the incidence of asymptomatic infections or prevent the spread of an infection.¹²¹ Finally, as discussed previously, the WHO recognizes that travel and trade restrictions are ineffective.¹²²

To prevent the spread of cholera the WHO guidelines advise health education, proper disposal of dead bodies, and disinfection.¹²³ Outbreaks can be more effectively controlled if people are educated as to how cholera spreads and how to recognize unsafe conditions. Key points that the WHO emphasizes for public education include: (1) only drink water from a safe source or water that has been properly disinfected by boiling or chlorination; (2) completely cook food or reheat it and eat food while it is still hot; (3) unless foods can be peeled or shelled, avoid uncooked foods; (4) wash hands after contact with fecal matter and before preparing and eating food; and (5) promptly and safely dispose of human excreta.¹²⁴

Also, the WHO guidelines strongly emphasize disinfection and use of adequate sanitation. Incineration is the suggested method of disposal for semisolid wastes, and disinfectants such as cresol or lysol should be used to clean areas of concern such as toilets.¹²⁵ For victims who have died from cholera, the WHO recommends that funerals be "held quickly and near the place of death" and with minimal physical contact with the body.¹²⁶

In addition to developing disease specific guidelines, the WHO has revised its *Guidelines for Drinking-Water Quality* which can be directly applied to cholera control.¹²⁷ The content of these guidelines illustrates an increasing awareness that

117. *See id.*

118. *See id.* §§ 3.1-3.

119. *See id.* § 7.3.1.

120. *See id.* § 7.3.2.

121. *See id.*

122. *See id.* § 7.3.3.

123. *See id.* §§ 7.1-7.2.

124. *See id.* § 7.1, box 10.

125. *See id.* § 7.2.

126. *Id.* The WHO suggests, for victims of cholera, limiting ritual washing of the dead or funeral feasts in order to minimize contributing to the spread of an epidemic. *See id.*

127. *See* World Health Org., *Specific Programmes in Environmental Health, Drinking-Water Quality Guidelines* (visited Feb. 11, 1999) <<http://www.who.int/peh/specprg.htm> Drinking-Water Quality Guidelines>. Volumes one and two of the *WHO Guidelines for Drinking-Water Quality*

environmental protection, once put into regulations, can be an effective approach to disease prevention. For instance, volume two, section 11.1.2, which discusses source protection of drinking water, is applicable to the preventative control of cholera. Section 11.1.2 states that to protect drinking-water sources: (1) geographical areas should be determined where sewage and sludge may not be applied, and (2) discharge of sewage effluents should be strictly controlled.¹²⁸ Additionally, section 11.1.2 emphasizes the protection of sources of groundwater, such as springs and wells; they should always be located and constructed in a manner which will protect them from surface drainage and flooding.¹²⁹

2. Pan American Health Organization

The Pan American Health Organization ("PAHO") is an international public health agency that serves as the specialized organization for the health of the Inter-American System.¹³⁰ The PAHO promotes health care strategies by assisting countries in preventing the spread of infectious disease epidemics, promoting information exchange and technical cooperation including education, promoting interaction with non-governmental organizations for health care purposes, and lending financial assistance for programs to prevent AIDS transmission.¹³¹

One of the highest priorities of the PAHO is protecting food against disease contamination. At the Seventh Inter-American Meeting, PAHO created a food protection plan, approved by authorities of the PAHO participating countries, that had five objectives: (1) establish an organization of integrated national food protection programs; (2) improve quality of laboratory work; (3) improve site inspection methods; (4) create an institution that will serve as an epidemiological surveillance system specifically for food-borne illnesses; and (5) promote protection of food by utilizing community participation.¹³² In response to the 1991 cholera epidemic that afflicted the Americas, the PAHO not only established a cholera task force, but also developed a two-step tactical strategy that consisted of

are currently available, and volume three is expected to be published this year. Volume one describes the criteria used in selecting contaminants to be considered, the approaches used to derive the guideline values, and essential information required to understand the basis for each value. *See id.* Volume two elaborates greatly on the health risk assessments of microbial contaminants presented in volume one. *See id.* Volume three is intended to serve a different purpose than volumes one and two; it contains recommendations and information concerning the surveillance and control of drinking water for small communities, particularly in rural areas of developing countries, and regarding measures to safeguard their water supplies. *See id.*

128. *See* 2 WORLD HEALTH ORG., GUIDELINES FOR DRINKING-WATER QUALITY §11.1.2, at 108 (2d ed. 1996).

129. *See id.*

130. *See* Pan Am. Health Org., *About PAHO* (last modified Jan. 15, 1997) <<http://www.paho.org/english/whatpaho.htm>>.

131. *See id.*

132. *See* Claudio Almeida, *Prospects for Technical Cooperation of the Pan American Health Organization in Food Protection in View of the Cholera Epidemic on the American Continents*, in CHOLERA ON THE AMERICAN CONTINENTS, *supra* note 8, at 61, 62.

short-term efforts and long-term efforts.¹³³ The short-term efforts concentrated on controlling the epidemic through basic measures for food hygiene and sanitation, whereas the long-term efforts focused on developing and improving environmental sanitation and food protection infrastructures.¹³⁴

3. Panel of Experts on Environmental Management for Vector Control

In 1981, the Panel of Experts on Environmental Management for Vector Control ("PEEM") was created by the joint effort of the WHO, the Food Agricultural Organization ("FAO"), the United Nations Environmental Programme ("UNEP"), and the United Nations Centre for Human Settlements ("UNCHS"). The function of PEEM is "to create a framework for inter-agency and inter-institutional collaboration [in order to] promot[e] the . . . use of environmental management for disease vector control as a health safeguard in the context of land and water resources development projects."¹³⁵ Pursuant to its initial establishment, PEEM expanded its focus also to incorporate "human settlements, urbanization and urban environmental management including urban water supply, sanitation, drainage and solid waste disposal."¹³⁶

The significance of the formation of PEEM to cholera is twofold. First, it represents a growing understanding in the international public health arena that disease control must be achieved by taking proactive measures. This organization emphasizes the importance of controlling the vector, the element that carries the disease and promotes its proliferation, to prevent disease, instead of simply reacting to an outbreak. Hence, they utilize preventative health policy by focusing on the vectors of disease. The value of preventative health policy is critical to the control of cholera. Prevention equals elimination of disease spread. Second, PEEM's policies that promote the extensive use of environmental management for disease control are a powerful means to get public health officials to recognize the critical link between environmental protection and human health.

PEEM's program activities include promotion, research and development, and capacity building. As a promotion effort, PEEM has organized several seminars in Kenya, Benin, and Zambia on water resources development and vector-borne diseases. One example of PEEM's capacity-building efforts is the series of workshops conducted by PEEM on the promotion of environmental management for disease vector control.¹³⁷

133. *See id.*

134. *See id.*

135. World Health Org., *Environmental Management for Vector Control and Health in Water Resources Development* (visited Mar. 19, 1999) <[http://www.who.int/peh/specprg.htm#Environmental Management for vector co](http://www.who.int/peh/specprg.htm#Environmental%20Management%20for%20vector%20co)>.

136. *Id.*

137. *See id.*

C. International Environmental Law

Perhaps one of the most useful, and most overlooked, areas of international law applicable to infectious diseases is international environmental law. The lack of prior investigation into its application to cholera mandates the need for a detailed examination of the sources of international environmental law and how those sources can be applied to the control of cholera.

1. Sources of International Environmental Law

International environmental law has evolved rapidly since the end of the 1960s, emerging as a new and dynamic addition to the international law regime.¹³⁸ Identified sources of international environmental law include: (1) international conventions concerning environmental protection; (2) customary international law; (3) judicial decisions; (4) non-binding resolutions adopted by international organizations; and (5) non-binding declarations of principles as well as recommendations by international conferences.¹³⁹

The first source of international environmental law is that of conventions combined with the international mechanisms for implementing them.¹⁴⁰ Treaties are an effective means of protecting the environment because they can be tailored to address specific environmental concerns of individual geographic areas.¹⁴¹ Additionally, it is a fundamental obligation of international law that treaties are observed and their obligations are performed in good faith.¹⁴² Under such an obligation, states which are party to a treaty are likely to supervise implementation of treaty provisions by other party states. Another beneficial characteristic of treaties is that they often require state parties to undertake precise obligations or refrain from specific conduct.¹⁴³ One example is the reporting of environmentally damaging incidents to a particular international organization which is intended to fulfill a supervisory role. Treaties, with or without the incorporation of supervisory international organizations, can be viewed as one mechanism to promote cooperation among states.¹⁴⁴

International environmental law founded in customary law is extremely useful because the vertical hierarchy of international environmental law is unclear and incomplete. In contrast to treaties, international customary law is largely a

138. See ALEXANDRE KISS & DINAH SHELTON, *INTERNATIONAL ENVIRONMENTAL LAW* 33, 36-37 (1991).

139. See *id.* at 96-113.

140. See *id.* at 98; see also Lakshman Guruswamy, *International Environmental Law: Boundaries, Landmarks, and Realities*, NAT. RESOURCES & ENV'T, Fall 1995, at 43, 43-44.

141. See KISS & SHELTON, *supra* note 138, at 96-97.

142. See Vienna Convention on the Law of Treaties, *opened for signature* May 23, 1969, art. 26, 1155 U.N.T.S. 331, 339, 8 I.L.M. 679, 690.

143. See KISS & SHELTON, *supra* note 138, at 98.

144. See *id.* at 99-100.

consequence of uniformities of behavior among states rather than the result of a formal written agreement.¹⁴⁵ Hence, customary law requires common recognition among states that a certain practice is obligatory.¹⁴⁶ Customary law must be factual and definable. Generally, for a rule or principle to emerge as customary law, the following basic requirements must be fulfilled: (1) concordant practice by multiple states; (2) general consent in the practice by states; and (3) *opinio juris*—that the custom is understood to be law.¹⁴⁷

Given the requirements to establish customary law, perhaps it is surprising to suggest that customary international law has a role in an area of law as new as international environmental law. However, international environmental law has evolved rapidly, and with that development is the possibility to have rapid development of customary laws pertaining to the environment. For instance, it is feasible to discern from current norms "evidence of a general practice, accepted as law," even if only a short period of time has passed in which this practice has arisen.¹⁴⁸

International customary law can be incorporated into treaties as tools for protecting the environment. For example, the Conference on the Law of the Sea which met between 1973 and 1982 adopted a treaty in which a consensus on several new norms arose even before the treaty was adopted.¹⁴⁹ One of these norms, later codified in Part V of the Convention, recognized the exclusive economic zones in which the sovereign rights of the coastal states to conserve and manage natural resources and the marine environment are to be maintained.¹⁵⁰

Judicial decisions of the International Court of Justice must not be overlooked. Cases such as *Trail Smelter*,¹⁵¹ *Corfu Channel*,¹⁵² and *Lake Lanoux*¹⁵³ have made significant contributions to the development of international environmental law. *Trail Smelter* has often been considered as having established the foundations of international environmental law with regards to transfrontier pollution.¹⁵⁴ Inclusive in the definition of transfrontier pollution is water pollution that affects a shared

145. *See id.* at 78.

146. *See id.* at 106.

147. *See id.* *See generally* KAROL WOLFE, CUSTOM IN PRESENT INTERNATIONAL LAW 9-44 (2d ed. 1993) (outlining the scope and terminology of international law, and exploring the elements of international custom as defined by various international legal authorities).

148. KISS & SHELTON, *supra* note 138, at 105.

149. *See id.*

150. *See* United Nations Convention on the Law of the Sea, *opened for signature* Dec. 10, 1982, art. 192, 21 I.L.M. 1261, 1309 [hereinafter UNCLOS].

151. *Trail Smelter Arbitration* (U.S. v. Can.), 3 R.I.A.A. 1905 (Temp. Trib., Decision of Mar. 11, 1941).

152. *Corfu Channel* (U.K. v. Alb.), 1949 I.C.J. 4 (April 9).

153. *Affaire du lac Lanoux* [Lake Lanoux Arbitration] (Spain v. Fr.), 12 R.I.A.A. 281 (Trib. Arbitral Nov. 16, 1957).

154. *See* KISS & SHELTON, *supra* note 138, at 107. *Trail Smelter* was the first case of transboundary pollution. *See id.* at 103. The court in *Trail Smelter* recognized the responsibility of a state for acts of pollution that originated within it and that cause damage to other states. *Trail Smelter Arbitration*, 3 R.I.A.A. at 1938-80.

international watercourse.¹⁵⁵ The foundations laid by *Trail Smelter* were confirmed by a more general principle enunciated in *Corfu Channel* followed by the *Lake Lanoux* arbitration which then further re-enforced them in the context of transfrontier water pollution.¹⁵⁶

Finally, the last source of international environmental law that will be addressed is the role of non-binding resolutions adopted by international organizations, such as the WHO, and the recommendations and declarations of principles of conferences such as the Stockholm Declaration of the United Nations Conference on the Human Environment.¹⁵⁷ These non-binding sources of regulation are extremely valuable to international environmental law because they are often the product of policy experts and scientists who truly understand the needs that must be met in order to protect the environment. Non-binding resolutions and recommendations can serve as the forerunners to treaty law,¹⁵⁸ and they can be adopted into treaties by participating states.

2. Marine and Water Pollution

International environmental law that pertains to marine and water pollution is critical in the evaluation of the international control of cholera. Marine pollution is predominately derived from land-based sources of pollution such as sewage, and industrial and agricultural runoff. Land-based sources of pollution that contaminate marine environments can contribute to the spread of infectious diseases such as cholera, yet they are not the sole source of infectious disease spread.

The vital importance of the world's freshwater resources cannot be underestimated. Three percent of the earth's total water is fresh water and seventy-seven percent of this fresh water is trapped in the polar ice caps and glaciers.¹⁵⁹ The world's supply of freshwater is unevenly distributed, often unreliable, and faces increasing and serious environmental stress. Furthermore, it is important to realize that a substantial number of these freshwater resources are also considered to be shared resources. Approximately 214 river basins across the world are shared by

155. See KISS & SHELTON, *supra* note 138, at 116-18.

156. See *id.* at 107-08. The transboundary pollution principle set out in *Corfu Channel* was that every state has an obligation to not knowingly allow its territory to be used contrary to the rights of others. 1949 I.C.J. at 45. *Lake Lanoux* set forth the principle that if one country, such as France, polluted a water source which it shared with another country (in this case Spain), damaging the second country's interests, the damaged country can claim that its rights have been impaired by the polluting country's actions. *Lake Lanoux Arbitration*, 12 R.I.A.A. at 303.

157. See KISS & SHELTON, *supra* note 138, at 110-13; *Report of the United Nations Conference on the Human Environment, Stockholm*, U.N. Doc. A/CONF.48/14/Rev. 1 *passim* (1972) [hereinafter *Stockholm Declaration*].

158. See generally Peter H. Sand, *Lessons Learned in Global Environmental Governance*, 18 B.C. ENVTL. AFF. L. REV. 213, 239-41 (1991) (discussing the development of "soft laws" and manner in which such laws evolve into treaties).

159. See *The State of the World Environment*, U.N. Env't Programme, at 27, U.N. Doc. UNEP/GC.16/9 (1991).

two or more states.¹⁶⁰ Additionally, in at least fifty states, more than seventy-five percent of their land is within a shared river basin region, and it is estimated that thirty-five to forty percent of the world's population lives in these shared river basin regions.¹⁶¹

Treaties that protect inland and marine waters are critical to the control of cholera. Although deserving of significant attention, land-based sources of marine pollution have not been given priority in the development of environmental laws to protect the marine environment. Nevertheless, some law does exist. The 1982 United Nations Convention on the Law of the Sea ("UNCLOS") has refined its marine protection and preservation requirements. Under the Convention, states have the general "obligation to protect and preserve the marine environment."¹⁶² This general obligation may be viewed as inhibiting states from exercising their sovereign rights. However, it does not. Rather, the UNCLOS obligation dictates that state sovereign rights may only be exercised within the context of protecting and preserving the marine environment. The Convention grants states varying degrees of competence to prescribe and apply laws to "prevent, reduce, and control pollution of the marine environment" from different sources.¹⁶³ Among these sources of marine pollution are pollution from land-based resources¹⁶⁴ and pollution from dumping.¹⁶⁵ The consequence of this state proscribed discretion is that land-based marine pollution does not typically enjoy the same level of pollution prevention standards as other forms of marine pollution. Furthermore, criticism of the UNCLOS provisions suggests that they fail to "force coastal States to adopt international standards or standards at least as effective as international standards."¹⁶⁶ The UNCLOS also obligates states to undertake cooperative measures, including notification, consultation, information exchange, and technical assistance.¹⁶⁷

In addition to the UNCLOS, regional treaties exist that pertain to land-based marine pollution. Many of these regional treaties developed under the direction of the UNEP do not go beyond the scope of the UNCLOS.¹⁶⁸ For instance, Article 7 of the Convention on Co-operation in the Protection and Development of the Marine and Coastal Environment of West and Central African Region states that parties "shall take all appropriate measures to prevent, reduce, combat and control pollution of the Convention area caused by discharges from rivers, estuaries, coastal establishments and outfalls, coastal dumping or emanating from any other source

160. *See id.* at 29.

161. *See id.*

162. UNCLOS, *supra* note 150, art. 192, at 1309.

163. *Id.* art. 104, at 1308.

164. *See id.* arts. 207, 213, at 1310-11.

165. *See id.* arts. 213, 216, at 1310, 1312.

166. FIDLER, *supra* note 58 (manuscript at 746) (describing how Article 208(3) (pollution from sea-bed activities), Article 210(6) (dumping), and Article 211(2) (pollution for vessels) have higher pollution standards than that of land-based marine pollution).

167. *See* UNCLOS, *supra* note 150, arts. 197-203, at 1308-09.

168. *See* FIDLER, *supra* note 58 (manuscript at 746).

on their territories.”¹⁶⁹ In addition to regional treaties developed by UNEP efforts, there are several treaties which protect the marine environment such as the 1974 Convention for the Prevention of Marine Pollution for Land-Based Sources, and the 1974 Convention on the Protection of the Marine Environment of the Baltic Sea.¹⁷⁰

Protection of inland waters by international environmental law has not proven sufficient. Apart from specific treaty regimes, there is little support for the view that water pollution resulting from industrial effluents, agricultural runoff, or domestic sewage discharge is per se prohibited.¹⁷¹ “[E]vidence of state practice [to protect waters often] is inconsistent [and] few . . . treaties endorse an absolute prohibition on detrimental alteration of water quality.”¹⁷² Rather, what appears to be the trend in treaties is the requirement of states to regulate and control water pollution by prohibiting only certain forms of pollutant discharge.¹⁷³ Furthermore, conventions concerning the protection of rivers are often limited to specific regions and do not encompass entire river basins.¹⁷⁴ To illustrate, conventional international provisions provide limited protection of the Rhine River because they encompass only a region from the river’s mouth to its exit from Lake Constance.¹⁷⁵ The segment of the river above Lake Constance is protected by another treaty.¹⁷⁶ Additionally, individual treaties define the waterway to be protected differently, thus resulting in an extreme

169. Convention on Co-operation in the Protection and Development of the Marine and Coastal Environment of West and Central African Region, *opened for signature* Mar. 23, 1981, art. 7, 20 I.L.M. 746, 749; *see also* Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, *opened for signature* Nov. 25, 1986, art. 7, S. TREATY Doc. No. 101-21, at 10 (1990), 26 I.L.M. 38, 45-46; Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution, *opened for signature* Apr. 24, 1978, art. VI, 1140 U.N.T.S. 133, 157; Convention for the Protection of the Mediterranean Sea Against Pollution, *opened for signature* Feb. 16, 1976, art. 8, 1102 U.N.T.S. 27, 47.

170. Convention for the Prevention of Marine Pollution from Land-Based Sources, *opened for signature* June 4, 1974, 13 I.L.M. 352; Convention on the Protection of the Marine Environment of the Baltic Sea Area, *opened for signature* Mar. 22, 1974, 13 I.L.M. 546.

171. *See* PATRICIA W. BIRNIE & ALAN E. BOYLE, *INTERNATIONAL LAW AND THE ENVIRONMENT* 224 (1992).

172. *Id.* at 224-25. Treaties that do absolutely prohibit pollution include: Agreement Concerning Frontier Watercourses, Apr. 24, 1964, Fin.-U.S.S.R., art. 4, 537 U.N.T.S. 231, 254; Treaty Concerning the Regime of the Soviet-Polish State Frontier and Co-operation and Mutual Assistance in Frontier Matters, Feb. 15, 1961, U.S.S.R.-Pol., art. 19, 42 U.N.T.S. 161, 256 [hereinafter Soviet-Polish Frontier Treaty]; Agreement Concerning the Regime of the Soviet-Czechoslovakia Frontier and the Procedure for the Settlement of Frontier Incidents, Nov. 30, 1956, U.S.S.R.-Czech., art. 14, 266 U.N.T.S. 243, 312 [hereinafter Soviet-Czechoslovakia Frontier Agreement]. *See also* Act of Santiago Covering Hydrologic Basins, June 26, 1971, Arg.-Chile, 3 C.H.I.T. 818 (Chile).

173. *See* BIRNIE & BOYLE, *supra* note 171, at 225. In determining certain forms of prohibited pollutant discharge, states are also required to distinguish between new and existing pollution sources. *See id.*

174. *See* KISS & SHELTON, *supra* note 138, at 203.

175. *See id.*

176. *See id.*

variance of protective legal force. Some treaties refer to watercourses,¹⁷⁷ others to water systems,¹⁷⁸ and still others to frontier waters.¹⁷⁹ Variances in defining waterways can lead to inconsistent and inadequate protection against pollution.

Legislation passed by the European Community ("EC") is arguably the most developed international protection against water pollution. The EC has implemented numerous directives aimed at protecting human health by establishing water quality standards for a variety of sources and uses. The directives tend to be technical in nature and set standards for human consumption,¹⁸⁰ bathing,¹⁸¹ and fishing.¹⁸²

At the forefront of international customary law applied to water resources is the duty not to cause appreciable or significant harm.¹⁸³ It prescribes that no state may use its territory or allow the use of its territory in a way that causes serious damage to another state.¹⁸⁴ This principle further mandates that states make conscious efforts to avoid transboundary pollution which can be applied to both water quantity and quality.¹⁸⁵

The obligation not to cause significant harm to other states by transboundary water pollution is complicated by the customary law principle of equitable utilization. The duty of equitable and reasonable utilization is another widely recognized rule of international customary law that applies to transboundary water

177. See U.N. Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Mar. 17, 1992, 31 I.L.M. 1312.

178. See, e.g., Agreement Between the Government of the Federal People's Republic of Yugoslavia and the Government of the Hungarian People's Republic Together with the Statute of the Yugoslav-Hungarian Water Economy Commission, Aug. 8, 1955, Yugo.-Hung., in UNITED NATIONS LEGISLATIVE SERIES: LEGISLATIVE TEXTS AND TREATY PROVISIONS CONCERNING THE UTILIZATION OF INTERNATIONAL RIVERS FOR PURPOSES OTHER THAN NAVIGATION 830, U.N. Doc. ST/LEG/SER.B/12, U.N. Sales No. 63.v.4 (1963).

179. See, e.g., Agreement Concerning the Use of Water Resources in Frontier Waters (with annex), Mar. 21, 1958, Czech.-Pol., 538 U.N.T.S. 89.

180. See Council Directive 75/440, 1975 O.J. (L 194) 26 (concerning the quality required of surface waters intended for abstraction of drinking water); Council Directive 79/869, 1979 O.J. (L 217) 44 (relating to the methods of measurement and frequency of sampling and analyzing of surface waters to be used for drinking); Council Directive 80/778, 1980 O.J. (L 299) 11 (relating to the quality of water intended for human consumption).

181. See Council Directive 76/160, 1976 O.J. (L 31) 1 (concerning the quality of bathing waters).

182. See Council Directive 78/659, 1978 O.J. (L 222) 1 (concerning the quality of fresh water needing protection or improvement in order to support fish life); Council Directive 79/923, 1979 O.J. (L 281) 47 (relating to the quality required of shellfish waters).

183. See ANDRÉ NOLLKAEMPER, *THE LEGAL REGIME FOR TRANSBOUNDARY WATER POLLUTION: BETWEEN DISCRETION AND CONSTRAINT* 30-31 (1993) (stating that the duty to prevent significant transboundary harm is a well-established principle of customary law as evident by its reflection in international agreements such as Principle 21 of the Stockholm Declaration and Part V of UNCLOS).

184. See Dante A. Caponera, *The Role of Customary International Water Law*, in *WATER RESOURCES POLICY FOR ASIA* 365, 380-81 (Mohammed Ali et al. eds., 1987).

185. See *id.*

pollution.¹⁸⁶ It is founded on the ideal of an equality of rights, or shared sovereignty, and should not be confused with equal division.¹⁸⁷ Additionally, the principle of equitable utilization purports that each state is entitled, within its territory, to a "reasonable and equitable share in the beneficial uses of the waters" of a shared river, lake, or basin.¹⁸⁸ Thus, under the principle of equitable utilization, a state rightfully may use its waters for discharge, but in doing so a state may not deprive another state of its right to an equitable share of water which it intends to utilize for its own purposes.¹⁸⁹ The challenge lies within striking the perfect balance between equitable utilization and a duty not to harm.

A duty not to cause environmental harm to other states was also recognized by the international judiciary system. The *Trail Smelter* case left a long-lasting impact on international environmental law applicable to water pollution.¹⁹⁰ Two key principles were established under *Trail Smelter*. The first is the recognized "responsibility of a state for acts of pollution having their origin on its territory and causing damage on the territory of other states."¹⁹¹ The significance of this principle is profound in that now a state may be held responsible for failing to enact necessary legislation and for not enforcing its environmental laws against offenders within its jurisdiction.¹⁹² The second principle to arise from *Trail Smelter* is the recognition of international responsibility to solve environmental problems.¹⁹³ The *Trail Smelter* judgment affirmed the existence of an international environmental law forbidding transboundary pollution. *Lake Lanoux Arbitration*¹⁹⁴ later reaffirmed those same principles established by *Trail Smelter* holding that a state is prohibited against utilizing a sovereign right pertaining to international waterways that will be detrimental to another state.¹⁹⁵

Finally, many significant non-binding declarations and principles have evolved since the 1972 Stockholm Declaration on the Human Environment. The Stockholm Declaration does not specify types of protective measures of freshwater sources from pollution. Nevertheless, pollution protection of water sources can fall within Principle 6 of the Stockholm Declaration. Principle 6 calls for ceasing "[t]he discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render

186. See NOLLKAEMPER, *supra* note 183, at 61.

187. See BIRNIE & BOYLE, *supra* note 171, at 217, 220.

188. Helsinki Rules on the Uses of the Waters of International Rivers, art. IV (without cmts. and annex), Aug. 20, 1966, 52 I.L.A. 477, 486 [hereinafter Helsinki Rules].

189. See L.F.E. Goldie, *Equity and the International Management of Transboundary Resources*, 25 NAT. RESOURCES J. 665, 676, 680-83 (1985).

190. *Trail Smelter Arbitration* (U.S. v. Can.), 3 R.I.A.A. 1905 (Temp. Trib., Decision of Mar. 11, 1941).

191. KISS & SHELTON, *supra* note 138, at 125; see also *Trail Smelter Arbitration*, 3 R.I.A.A. at 1965.

192. See KISS & SHELTON, *supra* note 138, at 125

193. See *id.*

194. *Affaire du lac Lanoux* [Lake Lanoux Arbitration] (Spain v. Fr.), 12 R.I.A.A. 281 (Trib. Arbitral Nov. 16, 1957).

195. See KISS & SHELTON, *supra* note 138, at 125-26; see also *Lake Lanoux Arbitration*, 12 R.I.A.A. at 316.

them harmless.”¹⁹⁶ A principle that applies particularly to water sources is found in Article IV of the Helsinki Rules which establishes the principle that each state within an international drainage basin has the right to a reasonable and equitable part of the beneficial use of the basin waters.¹⁹⁷ Additionally, Article X adds that, in conforming to the principle of equitable utilization under Article IV, each state should refrain from introducing new pollutants into international drainage basin waters or increasing levels of pollution that are likely to cause serious damage to the territory of another state in the drainage basin.¹⁹⁸

3. International Environmental Law and Cholera

If applied to the global control of infectious diseases, international environmental law could serve as an effective regulatory regime to aid in the control of cholera. International environmental law pertains directly to the health of the environment and not directly to the prevention of the spread of infectious diseases. However, common sense and experience indicate that human health is dependent on the health of the environment. Cholera and contaminated drinking water are clearly linked. Therefore, cholera and the quality of the aquatic environment are clearly linked. Utilizing international environmental law to protect the health of the environment can, in turn, protect the health of humans and prevent cholera outbreaks.

Rules and duties embodied in treaties are perhaps the greatest tools for the environmental control of infectious diseases. Treaties can specifically address the protection of water sources from sewage discharge and land-based pollution runoff that typically lead to environmental conditions conducive to cholera outbreaks. By establishing these environmental standards for shared water sources, treaties may also have the beneficial effect of motivating states to apply similar protective standards to internal or local water sources. Such a spillover effect would aid in preventing cholera outbreaks. More directly, treaties can specifically set forth environmental standards to protect against cholera. Treaties not only can set standards, but also can require information exchange to ensure that each state that is a party to the treaty has adequate technical knowledge to protect its water sources from cholera contamination. Furthermore, provisions can be incorporated into treaties that require states to cooperate in the prevention of cholera and once an outbreak occurs.

A few treaties already contain environmental provisions applicable to the control of cholera. One example is the UNCLOS which obligates states “to protect and preserve the marine environment” and “to prevent, reduce and control pollution of the marine environment”¹⁹⁹ from different sources which include pollution from land-based resources²⁰⁰ as well as pollution from dumping.²⁰¹ Additionally, the

196. *Stockholm Declaration*, *supra* note 157, at 4.

197. Helsinki Rules, *supra* note 188, art. IV, at 486.

198. *See id.* art. X, at 496-97.

199. UNCLOS, *supra* note 150, arts. 192, 194(1), at 1308.

200. *See id.* arts. 207, 213, at 1310, 1311.

201. *See id.* arts. 210, 216, at 1310, 1312.

UNCLOS obligates states to undertake cooperative measures, including notification, consultation, information exchange, and technical assistance.²⁰² The UNCLOS can be interpreted as an indirect means to prevent cholera because the primary objective of the treaty is to protect marine water quality. Inclusive in the obligation to prevent and control pollution of the marine environment is the requirement not to discharge sewage and other land-based pollutants that carry cholera.

Other regional treaties and conventions exhibit similar pollution prohibitions as found in the UNCLOS and similarly can be applied to cholera. Some examples include the 1974 Convention for the Prevention of Marine Pollution from Land-Based Sources, and the 1974 Convention on the Protection of the Marine Environment of the Baltic Sea.²⁰³ Both of these conventions contain provisions that protect marine waters from land-based pollution. Again, cholera can be indirectly controlled under these conventions by protecting against water pollution which may give rise to cholera outbreaks.

Protection of inland waters by international environmental law is less common than treaties to protect the marine environment. This is a significant drawback in looking for means to control cholera via international environmental law treaties because most cholera outbreaks occur from contaminated freshwater systems. Nevertheless, some do exist and should be used as general examples of how to protect inland water sources from infectious disease contamination. The EC has implemented numerous directives that establish water quality standards for various sources and uses, all of which are aimed at protecting human health. The EC directives set standards for human consumption, bathing, and fishing.²⁰⁴ By establishing specific criteria for water quality, the EC has addressed the issue of the spread of water-borne infectious diseases, and has significantly reduced the likelihood of a cholera outbreak through legal measures. Effectively, what the EC has done is to establish a legal regime that protects against cholera by protecting the environment. Although the EC as a whole can be considered a unique international structure unlike any other in the world, specific EC directives can, nonetheless, be used as general law-making models to ensure adequate, global protection against cholera by other states.

202. *Id.* arts. 197-201, at 1308-09.

203. Convention for the Prevention of Marine Pollution from Land-Based Sources, *supra* note 170, at 353. Article 1 of the convention states that parties pledge themselves to take all possible steps to prevent pollution of the sea, by which is meant the introduction by man, directly or indirectly, of substances or energy into the marine environment . . . resulting in such deleterious effects as hazards to human health, harm to living resources and to marine eco-systems.

Id.; Convention on the Protection of the Marine Environment of the Baltic Sea Area, *supra* note 170, at 547 (stating in Article 3 that the parties "shall individually or jointly take all appropriate legislative, administrative or other relevant measures in order to prevent and abate pollution and to protect and enhance the marine environment of the Baltic Sea Area").

204. *See supra* notes 180-82.

International customary law can serve as a legal construct to control cholera. The customary duty not to cause "appreciable or significant harm"²⁰⁵ to transboundary water resources can be interpreted as a duty to protect waters from cholera contamination. Embodied in this duty is the obligation that states make reasonable efforts to avoid transboundary pollution affecting both water quantity and quality. Customary law does not concisely define "appreciable or significant harm," thus, leaving it open for broad interpretation. Under a broad interpretation, discharge of sewage and other forms of fecally contaminated water that may give rise to cholera, all fall well within the customary law definition of "appreciable or significant harm." As a result, an argument can be made that customary law imposes obligations on states to protect inland and marine waters which includes the duty to protect from cholera contamination and spread. The argument can be supported further by the judicial decisions of *Trail Smelter* and *Lake Lanoux*. Those cases established the general proposition that a state can be held responsible for transfrontier water pollution,²⁰⁶ and, if the definition of pollution includes cholera, states then can be held responsible for discharging cholera contaminated sewage or other pollutants that might give rise to a cholera outbreak. If nothing else, application of such responsibility will encourage cholera-afflicted states to take greater measures to minimize spreading the disease to non-afflicted states.

The structure of international customary law has a fundamental benefit in its application to the control of cholera. International customary law develops from an accepted mode of behavior and, therefore, is likely to experience less resistance from states than other newly proposed rules and regulations. Less resistance by states may lead to more rapid adoptions of environmental laws for water resources that will indirectly serve to control cholera. In some regards this has already occurred. International environmental law derived from customary law has arisen rather quickly since the 1960s. The observed rapid development of this area of law leaves hope not only for more environmental laws to develop, but also for customary law which will serve as a mechanism to develop laws for environmental disease control. In addition, history has illustrated that customary law principles are commonly incorporated into treaties. This, in turn, inspires the belief that customary law principles concerning the environmental control of cholera will eventually be incorporated into treaties.

The concept that human health will be protected by protecting the environment is enumerated already in non-binding international environmental law. The Stockholm Declaration proclaims that the "Conference calls upon Governments and peoples to exert common efforts for the preservation and improvement of the human environment, for the benefit of all the people and for their posterity."²⁰⁷ Principle 1 of the Stockholm Declaration asserts that humans have a fundamental right to "adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and . . . bear[] a solemn responsibility to protect and

205. See NOLLKAEMPER, *supra* note 183, at 36.

206. See *supra* text accompanying notes 190-95.

207. *Stockholm Declaration*, *supra* note 157, at 4.

improve the environment.”²⁰⁸ Thus, Principle 1 sets a standard of environmental quality. Principle 24 reinforces the idea that states must work together to overcome global challenges: “Co-operation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce and eliminate adverse environmental effects resulting from activities conducted in all spheres.”²⁰⁹ By utilizing the guiding principles of the Stockholm Declaration, human health can be protected, including protection from cholera.

In 1992 the Rio Declaration sought to build upon the principles set out in the Stockholm Declaration twenty years before. It specifically addressed issues of environmental quality and development. Principle 1 of the Rio Declaration proclaims that human beings are “entitled to a healthy and productive life in harmony with nature.”²¹⁰ Such language infers a human right to live in an environment free of conditions that would seriously compromise health standards. Principle 1 of the Rio Declaration, as applied to cholera, would appear to require suitable water quality standards in order to prevent cholera. Furthermore, under consideration of the special circumstances of developing countries, Principle 4 proclaims that “environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.”²¹¹ Therefore, the Rio Declaration purports that development and environmental protection shall go hand-in-hand, and that, in turn, will directly serve to protect human health from diseases including cholera. Lastly, Principle 15 proclaims the use of the precautionary approach in order to protect the environment.²¹² The precautionary approach incorporates the value of taking measures to prevent detrimental results from environmental degradation.

Principles in the Helsinki Rules can provide protection of international rivers.²¹³ As noted before, protection of water sources can be utilized as a preventative measure in the control of cholera. Chapter 3, Article X of the Helsinki Rules proclaims that a state “must prevent any new form of water pollution or any increase in the degree of existing water pollution in an international drainage basin which would cause substantial injury in the territory of a co-basin State.”²¹⁴ For the purposes of Chapter 3, “water pollution” is defined as “any detrimental change resulting from *human conduct* in the natural composition, content or quality of the water of an international drainage basin.”²¹⁵ Such language renders the definition of pollution flexible. Therefore, Chapter 3 can be applied to sewage, legally requiring prevention of the increase or the initial pollution of human waste to a water source. By prohibiting this form of pollution, the amiable conditions for cholera can be limited, thereby reducing the likelihood of cholera outbreaks in an

208. *Id.*

209. *Id.* at 5.

210. *Rio Declaration on Environment and Development*, U.N. Conf. on Env't & Dev., at 2, U.N. Doc. A/CONF.151/5 (1992).

211. *Id.*

212. *See id.* at 4.

213. Helsinki Rules, *supra* note 188, art. II, at 484-85.

214. *Id.* art. X, at 496-97.

215. *Id.* art. IX, at 494-95 (emphasis added).

area. One must recognize, however, the unfortunate restrictions of the Helsinki Rules to the control of cholera. Chapter 1, Article II, clearly states that the general rules of international law set forth in the Helsinki Rules apply to water of an international drainage basin which geographically extends over two or more states.²¹⁶ This restriction limits the applicability of these rules to only those water sources that cross state boundaries.

Taken collectively these international principles, customs, and treaties, created to protect the environment, can be applied as an indirect control of the spread of infectious diseases. Cholera can be regulated through international environmental law because it protects the same environment that serves as a reservoir for cholera: water. As was explained in this Part, certain sources of international environmental law are specifically applicable to cholera because they focus on providing pollution protection for water resources. By guarding against pollution, international environmental law is taking a precautionary approach to defend against cholera.

D. International Trade Law

Given the intertwined relationship of trade and infectious diseases, international trade law is another area of law that has impacted international cholera control. The General Agreement on Tariffs and Trade ("GATT") was the first multilateral trade agreement that attempted to provide rules for global trade.²¹⁷ Article XX of GATT specifically attempts to balance the sovereign right of states to take measures for the protection of health with limitations on the abuse of this right.²¹⁸ Article XX reads:

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures . . . necessary to protect human, animal or plant life or health²¹⁹

Yet, this balance of rights did not protect Peru during its 1991 cholera outbreak. Peru's economy suffered substantially as a result of actions taken against Peruvian exports by other states. Peru complained to the GATT Council repeatedly that the GATT rules were being ignored and other states were imposing trade-damaging health protection measures against Peru that lacked scientific support or clear public health rationales.²²⁰

216. *See id.* art. II, at 484-85.

217. *See FIDLER, supra* note 58 (manuscript at 334).

218. *See id.*

219. General Agreement on Tariffs and Trade, Oct. 30, 1947, art. XX, 61 Stat. A3, A60-61, 55 U.N.T.S. 187, 262.

220. *See FIDLER, supra* note 58 (manuscript at 344).

The Agreement on the Application of Sanitary and Phytosanitary Measures ("SPS Agreement")²²¹ that grew out of the Uruguay Round of Negotiations is now the most important of the international trade laws to impact cholera control. The SPS Agreement puts forth measures to protect life or health of humans, animals, and plants, but at the same time these measures are not intended for use to negate the benefits of trade liberalization.²²² Among the key elements of the SPS Agreement is the requirement that sanitary and phytosanitary ("SPS") measures be based on scientific principles and evidence, and that states bound to the SPS Agreement must base their SPS measures on international standards.²²³

The significance of the SPS Agreement to cholera resides within the requirement that science be the basis for health protective measures. The SPS Agreement precisely dictates that member states will apply SPS measures only to the extent necessary to protect life or health of humans, animals, and plants; these measures will be based on scientific principles and will cease to be maintained if sufficient scientific evidence does not exist.²²⁴ Such language powerfully impacts the degree of action that can be taken to protect health and limit international trade. No longer can health policy that affects trade be created out of fear, superstition, or any other illegitimate basis. Scientific evidence must exist and support the rationale for enacting tariffs or other trade restrictions against a cholera-afflicted state, and in doing so will ensure that policy is made fairly and for legitimate reasons.

In addition, the SPS Agreement dictates that SPS measures be based on international standards, thereby promoting global uniformity for health standards.²²⁵ Application of international standards should promote fairness and deter discrimination. International standards may also provide a means to restrict states from taking extreme and excessive actions against a cholera-afflicted state, because they will not be able to take restrictive action until an international standard is met.

IV. DEFICIENCIES IN THE INTERNATIONAL CONTROL OF CHOLERA

Cholera is an age-old nemesis. All attempts to eradicate the disease on a global scale have failed. Indeed some developed nations have seemingly eliminated the threat that cholera will re-emerge, but so long as cholera outbreaks persist somewhere in the world, it will remain a health threat to all of humanity. Re-emergence and reoccurring outbreaks of cholera are attributable to several factors: environmental degradation, urbanization, poor sanitation, ineffective vaccines, ineffective regulations, and increased trade and travel. Among the most significant of these factors are the deficiencies in the current cholera control regime. This Part

221. Agreement on the Application of Sanitary and Phytosanitary Measures, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS: THE LEGAL TEXTS (1994) [hereinafter SPS Agreement].

222. *Id.* art. 2(3).

223. *Id.* arts. 2(2), 3(1); see also FIDLER, *supra* note 58 (manuscript at 351).

224. SPS Agreement, *supra* note 221, art. 2(2), 2(3).

225. *Id.* art. 3(1).

will examine the failed effectiveness of the four areas of international law that have attempted to control cholera: IHRs, the WHO Guidelines, international environmental law, and international trade law. Finally, this Part will conclude with an examination of how the concept of the human right to health also has failed in the control of cholera.

A. Failed Effectiveness of the IHRs

The IHRs have failed in preventing the international spread of cholera and other infectious diseases as evidenced by recent outbreaks and the continuing re-emergence of cholera.²²⁶ The IHRs have been inadequately applied, misapplied, and have proven to be substantively insufficient. The surveillance system of the IHRs is flawed in that member states often fail to notify the WHO that a cholera outbreak has occurred and are reluctant to share surveillance information.²²⁷ As a result of this breakdown in surveillance, a vicious cycle has developed of insufficient notification that gives rise to excessive regulatory measures taken by member states and these excess measures then give rise to failure to notify.²²⁸ Three reasons have been proposed as to why surveillance has failed: (1) the time lag in diagnosis of cholera; (2) the concern for maintaining national honor; and (3) the very real fear of excessive reaction by neighboring states.²²⁹

The lack of enforceability of the IHRs duties further detracts from its overall effectiveness. No provisions in the IHRs provide any international organization with enforcement power in connection with duties established in the IHRs.²³⁰ Enforcement is further weakened by the WHO's reluctance to issue enforceable legal rules, and instead choosing to issue "non-binding recommendations."²³¹ Hence, many of the objectives of the IHRs are undermined by the lack of enforceability.

The failure of the IHRs to adequately meet international health needs has been recognized. The IHRs are undergoing revision in accordance with a resolution

226. See DELON, *supra* note 96, at 23; Fidler, *supra* note 5, at 846; Mario Masana Wilson & César Chelala, *Letter From Buenos Aires: Cholera Is Walking South*, 272 JAMA 1226 *passim* (1994) (describing the spread of a cholera epidemic from three initial towns in Peru to all the countries in South America, with the exception of Uruguay, and to all Central American countries).

227. See *Cholera 0139 Spreading—Southeast Asia: Request for Info* (visited Mar. 23, 1999) <<http://www.healthnet.org/programs/promed-hma/9809/msg00147.html>> (describing that an unidentified Southeast Asian country is currently afflicted by a large cholera outbreak but is suppressing the information in violation of the WHO member states requirements); see also Fidler, *supra* note 5, at 844 (citing WORKING GROUP ON EMERGING AND RE-EMERGING INFECTIOUS DISEASES, NATIONAL SCIENCE AND TECH. COUNCIL COMM. ON INT'L SCIENCE, ENG'G AND TECH., INFECTIOUS DISEASES—A GLOBAL HEALTH THREAT 4 (1995)) (discussing the reluctance to share surveillance information); Laurie Garrett, *The Return of Infectious Disease*, FOREIGN AFF., Jan.-Feb. 1996, at 66, 74 (noting the reluctance of many nations to report infectious disease outbreaks to the WHO).

228. See DELON, *supra* note 96, at 24; Fidler, *supra* note 5, at 847.

229. See DELON, *supra* note 96, at 24.

230. See Fidler, *supra* note 5, at 848.

231. *Id.*

adopted by the World Health Assembly in 1995.²³² This action was taken in recognition that the regulations have fallen behind the current health needs of the global community. New patterns of risk, such as profound advances in transportation and increased environmental degradation, present new challenges to the international disease control community that did not exist when the IHRs were last revised. The revisions are intended to facilitate epidemic surveillance and control activities at regional, national, and international levels.²³³ Descriptions of the "best public health practices" as well as syndromes of international importance will be included.²³⁴ The revised IHRs are currently in draft form and WHA approval is anticipated in 2000.²³⁵ With these revisions, hopefully many of the flaws discussed in this Comment will be rectified. However, the effectiveness of the new revisions to regulate the spread of cholera will remain inconclusive until the revised IHRs are adopted and implemented.

B. Failed Effectiveness of the WHO Guidelines

The WHO cholera and drinking-water quality guidelines provide information and recommendations that are critical to the adequate control of cholera. However, the persistent re-emergence of cholera is evidence that the WHO guidelines have had only limited effectiveness in controlling cholera. The failure of the WHO guidelines to control cholera can be attributed to the fact that the WHO guidelines are just that, guidelines. They have no binding force under law. States can observe these guidelines and even incorporate them into their own laws, however, there is no international binding force that requires states to accept and follow the WHO guidelines. Until the WHO guidelines are established in multilateral and bilateral agreements or imposed by customary law and national law, they remain merely guidelines that have no enforceability.

In addition, a major flaw of the WHO cholera guidelines thus far is their failure to incorporate enough environmental protection. The *WHO Guidelines for Cholera Control* state that "all efforts must be made to provide safe drinking-water, as well as safe water for food preparation," yet they do not address how this is to be achieved.²³⁶ The greatest environmental, precautionary advice provided by the guidelines is to sterilize water by boiling.²³⁷ In fact, it appears that the *Guidelines for Cholera Control* fail to give any practical guidance to prevent cholera by means of protecting water from cholera contamination. To find the WHO guidance for water protection, persons interested in preventing cholera must turn to the

232. See World Health Org., *supra* note 98, at 234; World Health Org., *Revision of the International Health Regulations: Progress Report, December 1996*, 72 WKLY. EPIDEMIOLOGICAL REC. 9, 9 (1997) [hereinafter WHO, 1996 Progress Report]; World Health Org., *International Health Regulations* (last modified Apr. 24, 1998) <http://www.who.ch/emc/surveill/int_regs.html>.

233. See WHO, 1996 Progress Report, *supra* note 232, at 9-10.

234. See *id.*

235. See World Health Org., *supra* note 98, at 234.

236. *Guidelines for Cholera Control*, *supra* note 116, § 3.1.

237. See *id.*

Guidelines for Drinking-Water Quality.²³⁸ Herein lies the problem. The failure to incorporate drinking-water guidelines in the WHO cholera prevention strategy itself is a profound deficiency. Without directly addressing the environmental conditions that give rise to diseases such as cholera, the WHO guidelines will always err on the side of being reactive instead of proactive, and they will never provide a comprehensive and foolproof strategy to prevent cholera.

C. Failed Effectiveness of International Environmental Law

International environmental law has some fundamental drawbacks that may limit its effectiveness to control cholera. First, much of international environmental law is created through a rather slow treaty-making process. Ratification of agreements by states takes time, and will often delay the practical effectiveness of international agreements.²³⁹ Second, because no state is obliged to sign or ratify a treaty, most international environmental laws are based on consensus or unanimity.²⁴⁰ Therefore, there is no guarantee that all states that should be bound to a treaty will be bound. A third drawback is that internationally agreed upon standards tend to reflect the "lowest common denominator,"²⁴¹ and consequently result in failure to set the ideal standard for environmental or human health protection.

Traditional "treaty-making" is a useful method to formulate a framework for international relations and to establish generally accepted principles of behavior.²⁴² Therefore, it is a constructive means to establish proactive and long standing precautionary principles for environmental and health management. However, once established, these principles are slow to change and often fail to offer the mechanisms that are capable of contending with the evolving nature of infectious-disease control. Control of infectious diseases involves unforeseeable changes of circumstances as well as emergency situations. Critical to the success of international infectious disease management is a system's capacity to react well to rapidly changing situations. Without this critical component integrated into a regulatory scheme, cholera will never be adequately controlled. Thus, it is feasible that treaty-made international environmental law may lack the flexibility and emergency response qualities necessary to effectively regulate cholera.

Additionally, many of the obligations and duties that treaties implement are overly-broad and thus lack sufficient specificity to be truly effective in controlling cholera through environmental measures. For instance, although the UNCLOS requires party states to take measures to prevent and control pollution of the marine environment, it fails to set specific standards or give sufficiently detailed guidelines.

238. See generally 2 WORLD HEALTH ORG., *supra* note 128. The WHO dedicated an entire volume to guidelines for drinking-water quality, yet only a few sections, such as 11.1.2 and 11.2.3, address source protection or environmental protection. See *id.* §§ 11.1.2, 11.2.3, at 108, 109-10.

239. See Sand, *supra* note 158, at 219.

240. See *id.*

241. *Id.*

242. See *id.*

An argument has been made that the UNCLOS provisions are so overly-broad and lack specificity that they are likely to have little practical effect.²⁴³

Another problem with the application of international environmental law contained in treaties to cholera is that the majority of international environmental agreements pertaining to water resources focus on the marine environment and not on sources of drinking water. For example, the International Convention for the Prevention of Pollution of the Sea by Oil,²⁴⁴ the Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter,²⁴⁵ the Convention on the Protection of the Marine Environment of the Baltic Sea Area,²⁴⁶ and the International Convention for the Prevention of Pollution from Ships²⁴⁷ all pertain exclusively to the oceans and seas. To compound matters, many of these same agreements focus on inorganic pollution whereas cholera is most commonly a result of organic pollution. Illustrative of this is the Convention on the Prevention of Marine Pollution in which sewage, sludge, or other biological wastes are not among the materials listed as prohibited from dumping.²⁴⁸

Therefore, not only is there a lack of international environmental law to protect inland water sources, but those treaties that do protect marine environments still do not contain provisions to prohibit pollution by substances that can contribute to a cholera outbreak. Furthermore, evidence of state practices to protect waters is inconsistent, and few treaties endorse an absolute prohibition on detrimental alteration of water quality.²⁴⁹ In short, apart from the possibility of specific treaty regimes that directly address water quality, there is little evidence that water pollution from industrial effluents, agricultural runoff, or domestic sewage discharged is per se prohibited.²⁵⁰ Without per se prohibition or strictly imposed limitations on these cholera-conducive types of water pollutants, the threat of cholera outbreaks will remain.

243. See R.R. CHURCHILL & A.V. LOWE, *THE LAW OF THE SEA* 278 (rev. ed. 1988).

244. International Convention for the Prevention of Pollution of the Sea by Oil, May 12, 1954, 12 U.S.T. 2989, 327 U.N.T.S. 3.

245. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, Dec. 29, 1972, 26 U.S.T. 2403, 1046 U.N.T.S. 120 [hereinafter Convention on the Prevention of Marine Pollution].

246. Convention on the Protection of the Marine Environment of the Baltic Sea Area, *supra* note 170.

247. International Convention for the Prevention of Pollution From Ships, Nov. 2, 1973, T.I.A.S. No. 10561, 12 I.L.M. 1319.

248. Convention of the Prevention of Marine Pollution, *supra* note 245, art. XII & annexes I-II, 26 U.S.T. at 2411, 2465-66, 1046 U.N.T.S. at 143, 203 (prohibiting specifically the dumping of inorganic compounds, metals, and radioactive materials; however, sewage and other biological materials, except for those used for warfare, are not prohibited dumping substances under this convention).

249. See, e.g., *id.* arts. V-VI, 26 U.S.T. at 2409-10, 1046 U.N.T.S. at 141-42. Some treaties do absolutely prohibit detrimental alteration of water quality. See, e.g., Agreement Concerning Frontier Watercourses, *supra* note 172, art. 4, at 254; Soviet-Polish Frontier Treaty, *supra* note 171, art. 19, at 256; Soviet-Czechoslovakia Frontier Agreement, *supra* note 172, art. 14, at 312; Act of Santiago Covering Hydrologic Basins, *supra* note 172.

250. See BIRNIE & BOYLE, *supra* note 171, at 224.

Finally, none of the international environmental agreements address infectious disease control generally or cholera control specifically. Therefore, it is left to deduction as to whether international environmental law does, indeed, apply to the control of cholera.

The application of customary law to environmental problems faces some challenges, and therefore, will face similar challenges as applied to cholera. Among these challenges include ascertaining the custom, a state's liberty not to recognize custom, and the uncertainty in establishing a custom. Additionally, how quantity and quality of a shared resource can be determined by using custom is not fully clear. Furthermore, as the use and development of treaties increases, the reliance on customary law may diminish, thereby, weakening its legal potency. Two obvious disadvantages exist in the application of international customary law for water resources to cholera control. First, is the fact that it applies to marine and water pollution and not to cholera prevention. Second, water pollution protection has been limited in scope by equitable utilization, thereby reducing the degree of protection afforded to water resources and cholera prevention. Despite these difficulties, customary law still serves as an important role in the legal structure of international environmental law that can be applied to the international control of cholera.

D. Failed Effectiveness of International Trade Law—Excessive Measures and Trade

In application of the IHRs, WHO member states have repeatedly taken excessive measures to control the spread of cholera which are often in the form of trade and travel restrictions.²⁵¹ These restrictions are commonly unauthorized and unnecessary to prevent the spread of cholera, and violate international trade agreements.

As recently as December 1997, the EC responded to an outbreak of cholera in East Africa by imposing import bans against East African fishery products.²⁵² This action was in violation of the IHRs and the SPS Agreement. The IHRs establish the maximum degree of action that a WHO member state may apply to goods coming from a country suffering a cholera outbreak.²⁵³ Under the IHRs, WHO member states are not authorized to impose import bans on products from cholera-afflicted nations.²⁵⁴ Additionally, the WHO *Guidelines for Cholera Control* specifically state that trade restrictions do not prevent the spread of cholera.²⁵⁵ The WHO advises that travel and trade restrictions have never proven to be an effective method of controlling the spread of cholera, but, instead, that "sound public health practices are the most effective approach."²⁵⁶ Furthermore, the WHO has never documented

251. See DELON, *supra* note 96, at 24.

252. See Fidler, *supra* note 65.

253. See INT'L HEALTH REGS., *supra* note 97, arts. 62-63, at 30.

254. See David Fidler, *Cholera, Impact on Commercial Fishing—East Africa (02)* (visited Feb. 16, 1999) <<http://www.healthnet.org/programs/promed-hma/9801/msg00099.html>>.

255. *Guidelines for Cholera Control*, *supra* note 116, § 7.3.3.

256. James Chin, *PRO> Cholera—Africa: WHO Guidelines for Control* (visited Feb. 16, 1999) <<http://www.healthnet.org/programs/promed-hma/9801/msg00064.html>>.

a cholera outbreak due to commercially imported food substances.²⁵⁷ Thus, the EC import ban is neither supported by the WHO guidelines nor is it in compliance with the IHRs. Although not formally a WHO member state, the EC is comprised of individual WHO member states who are bound by the IHRs, and individually each member state would be in violation of the IHRs upon complying with a ban on fishery products from East Africa.²⁵⁸

In addition, the EC could well be in violation of the SPS Agreement that mandates risk assessment based on scientific principles and evidence.²⁵⁹ The EC bears the burden of adequately discerning that the ban is reasonable given the results of a scientific risk assessment. Without such scientific evidence, proven by scientific methods of risk assessment, the EC is in violation of the SPS Agreement for imposing such a sanitary measure.²⁶⁰

Many failed attempts to control the spread of cholera focused on controlling the movement of individuals or even whole populations. Identification of traveling infected persons is difficult, personally invasive, and expensive to enforce effectively. Additionally, control of travel may produce tourism loss due to disruption of the industry. For these reasons, the WHO recommends that states should not utilize quarantine and frontier control measures to prevent the spread of cholera.²⁶¹ Rather, resources are better spent addressing the environmental concerns associated with cholera.

E. Right to Health

Current international regulations to control cholera can be argued to have violated an international right to health. International human rights law can be one legal basis that would require the establishment of an international public health strategy to combat cholera effectively. However, to date this has not occurred. Many public health systems remain inadequate and have proven to be incapable of preventing the spread of infectious diseases.

The right to health has its foundation in public health movements of the nineteenth century that drove sanitation reforms designed to alleviate infectious disease epidemics.²⁶² The first declaration of a human right to health appeared in the WHO Constitution in 1946 which stated: "The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being"²⁶³ Following this declaration came other declarations and treaties

257. See *Guidelines for Cholera Control*, *supra* note 116, at box 12.

258. See Fidler, *supra* note 65.

259. See *id.* (referring to Articles 5(1) and 5(2) of the SPS Agreement); see also SPS Agreement, *supra* note 221, arts. 5(1), 5(2).

260. See Fidler, *supra* note 65.

261. See James Tulloch, *Global Considerations in the Control of Cholera*, in *CHOLERA ON THE AMERICAN CONTINENTS*, *supra* note 8, at 3, 7.

262. See FIDLER, *supra* note 58 (manuscript at 489-90).

263. WHO Const., *supra* note 95, pmbl., 62 Stat. at 2685, 14 U.N.T.S. at 186.

expressing the right to health.²⁶⁴ However, to interpret the right to health as a guarantee of individual good health is to discount the epidemiological lessons history has taught to humans: infectious diseases do not recognize a right to human health. In fact, regardless of the number of declarations or treaties preserving a right to health, infectious diseases have always and will continue to cause illness and death.

Establishing an international right to health standard is complicated by the variance of the environment between developing and developed nations. To reconcile such variance, the principle of progressive realization has been applied. This principle purports that the right to health "does not provide an absolute world standard but is rendered relative to the world health inequalities" between developing and developed countries.²⁶⁵ Hence, the right to health can be designed to reflect the reality of a nation's capabilities to provide for the public health. A significant problem with the application of progressive realization is the potential to overuse it. It may retard the pursuit of improving public health standards and serve as an excuse for the lack thereof.

The inadequacy of public health systems in many developing nations reflects a widely recognized truth that the minimum core obligations of states to individuals' rights to health are not being fulfilled.²⁶⁶ Cholera exemplifies the inadequacies. Cholera is easily preventable and treatable, yet it still kills thousands of people each year. The inability of many nations to halt its re-emergence and spread has brought to light the weaknesses of public health systems all over the globe. In 1991, the WHO estimated that 120 million people in Latin America were at risk of contracting cholera because of "poor sanitation, deterioration in maintenance of water systems, and contaminated food."²⁶⁷ In short, the cholera epidemic that swept Peru and other sections of Latin America demonstrated the weaknesses of the Latin American public health system. The incapacities of state public health systems to overcome cholera outbreaks can be interpreted as a defeat of the minimum core approach to the human right to health.

264. See FIDLER, *supra* note 58 (manuscript at 489-90). Some treaties mentioned include: the International Covenant on Economic, Social, and Cultural Rights, *entered into force* Jan. 3, 1976, 993 U.N.T.S. 3, 6 I.L.M. 360; the African Charter on Human and Peoples' Rights, *opened for signature* June 26, 1981, O.A.U. Doc. CAB/LEG/67/3/Rev.5, 21 I.L.M. 58; the Convention on the Rights of the Child, G.A. Res. 44/25, U.N. GAOR, 44th Sess., Supp. No. 49, U.N. Doc. A/44/736 (1989), *reprinted in* 28 I.L.M. 1448; and the Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social, and Cultural Rights, Nov. 17, 1988, 28 I.L.M. 146 (not yet in force). See FIDLER, *supra* note 58 (manuscript at 489-90).

265. CHARLES O. PANNENBORG, *A NEW INTERNATIONAL HEALTH ORDER: AN INQUIRY INTO THE INTERNATIONAL RELATIONS OF WORLD HEALTH AND MEDICAL CARE* 313 (1979).

266. See FIDLER, *supra* note 58 (manuscript at 489-90).

267. Allyn Lise Taylor, *Making the World Health Organization Work: A Legal Framework for Universal Access to the Conditions for Health*, 18 AM. J.L. & MED. 301, 308-09 (1992) (citations omitted).

V. RECOMMENDATIONS

The following Part sets forth recommendations to improve the control of cholera. The recommendations include the need for enhanced international cooperation in the fight against infectious diseases, the need for international environmental law to have a greater involvement in the control of infectious diseases, the need to improve efforts of environmental protection that will aid in controlling cholera, and the application of the concept of global health jurisprudence. Enhancing sanitation and environmental surveillance efforts are two mechanisms that will aid in environmental protection. Application of the precautionary principle also can assist in the control of cholera through environmental avenues. These recommendations are not the exclusive means to improve the global control of cholera, rather they seek to foster further investigation of alternative means to aid in the international regulation of cholera.

A. Need for Enhanced International Cooperation

There is an obvious need for enhanced international cooperation and information exchange for cholera that goes beyond the current efforts of the WHO and PAHO. Cooperation and information exchange once an epidemic has surfaced is not an effective means to proactively prevent the spread of cholera. Precautionary information exchange on the conditions, including the environmental conditions, that give rise to cholera is needed.

Greater cooperation among states, with a particular emphasis on maintaining water quality standards and preventing cholera contamination of drinking water, is needed. This can be partially achieved by utilizing the already established frameworks of cooperation for water resources. Also, there is the need for greater efforts to integrate data collection on health and global environmental changes. Diseases like cholera, which arise with degradation of environmental conditions, will only be eliminated if the environmental conditions that are associated with it are recognized and prevented. Therefore, to prevent cholera, data must be collected on environmental changes associated with cholera outbreaks and integrated with the human health aspects of disease control. Clearly a fusion between the health of the environment and human health is necessary to prevent cholera.

The established cooperative efforts of international water resources have applicability to cholera control. As a result of the importance of and the potential conflicts arising over water resources, many of the institutions of the United Nations ("U.N.") are engaged in activities involving water management and facilitating intergovernmental cooperation.²⁶⁸ One of the most substantial

268. See Dante A. Caponera, *Patterns of Cooperation in International Water Law: Principles and Institutions*, in TRANSBOUNDARY RESOURCES LAW 1, 11 (Albert E. Utton & Ludwik A. Teclaff eds., 1987). Institutional support is provided to the institutions of Benin-Togo, Cameroon-Chad, Senegal, Burundi, Rwanda, Tanzania, Gambia, Guinea, Paraguay, Brazil, Uruguay, Greece, Yugoslavia, Liberia, and Sierra Leone. See *id.* at 11 n.30.

recommendations for water resources cooperation comes from the plan developed at the U.N. Water Conference held in 1977. The plan stated that:

"States sharing water resources . . . should cooperate in the establishment of programs, machinery, and institutions necessary for the coordinated development of such resources . . . and establish joint committees . . . to provide for the . . . collection, standardization and exchange of data, the management of shared water resources, the prevention and control of water pollution, *the prevention of water associated diseases*, mitigation of drought, flood control, river improvement activities, and flood warning systems."²⁶⁹

In addition, non-binding principles of international environmental law contain cooperation requirements. Principle 24 of the Stockholm Declaration declares that "cooperation through multilateral or bilateral arrangements is essential in international relations to protect and improve the environment."²⁷⁰ Following the Stockholm Declaration, the U.N. Environmental Programme was created "to implement international cooperation regarding environmental aspects of shared water resources."²⁷¹

These established principles and organizations to promote cooperation among nations represent only a fraction of the cooperation requirements found in international environmental law that can and should be applied to the control of infectious diseases. They are powerful tools that are intended to prevent environmental harm, but can be used to prevent infectious diseases as well. It is bewildering that the existing principles and legal frameworks to protect water have not been mentioned or integrated in the control strategies of infectious diseases. Their utility to cholera control is invaluable.

International cooperation does face a fundamental challenge in its application to cholera control. Requirements for states to cooperate with one another are rarely found outside of international agreements, thus, rendering cooperation as a conditional obligation. However, an exception is found in principles of international customary law, and for the purposes of controlling cholera it is the exception and not the norm that should be used. The exception is the duty to cooperate, which is a relatively well accepted principle of international customary law that has been applied generally to environmental issues. Applicable to the prevention of cholera is the duty to cooperate in protection of water resources, especially with regard to "the spread of waterborne diseases."²⁷² This duty can be interpreted in two ways. On the one hand, it can be understood to impose a duty for states to take individual actions within their jurisdictions to protect against infectious water-borne diseases, such as cholera, as a cooperative effort to curb the international spread of disease. On the other hand, the duty to cooperate can be understood as requiring states to work directly with each other in order to develop strategic plans and agreements to combat the spread of infectious diseases.

269. *Id.* at 11 (quoting REPORT OF THE UNITED NATIONS WATER CONFERENCE at 180, Mar. 14-25, 1977, U.N. Sales No. E.77.II.A.12 (1977) (emphasis added) (omissions in original)).

270. *Id.* at 12 (citing *Stockholm Declaration*, *supra* note 157, princ. 24, at 5).

271. *Id.*

272. *Id.* at 8.

Enhanced international cooperation may help in the control of cholera by alleviating some of the existing health inequalities between developed and less-developed nations. Cholera is a potential threat to all countries, yet it takes its greatest toll on developing countries. Poorer nations often lack the economic resources to improve water quality and sanitation, thereby, leaving them more susceptible to cholera outbreaks. International cooperation, as established in treaties or by customary law, may help to diminish cholera outbreaks by encouraging international efforts to ensure that all nations provide adequate water quality and sanitation. These efforts can be in the form of enhanced monetary aid to build and maintain needed sanitation systems or increased international efforts in education about disease prevention. Cooperation can also take the form of enhanced information exchange in health and environmental policy, sanitation technology, and public health systems.

With every undertaking that involves as many issues as the control of cholera, there will exist challenges. But, policy and law makers should not be discouraged by these challenges. Rather, these challenges should be an indicator of why international cooperation is so critical. Through augmented international cooperation, nations may be able to share resources, knowledge, policies, and technology that will directly reduce the fear of cholera and friction among states while also helping to formulate an international framework for the effective control of cholera.

*B. Need for Environmental Law to Have a Greater
Involvement in the Control of Infectious Diseases*

Environmental regulations can be viewed as a means to prevent human disease through protection of the human environment. Water is among the most critical of natural resources to protect in order to guard human health. Scientific evidence has demonstrated that water quality is directly related to cholera epidemics.²⁷³ Historically, water was probably one of the first natural resources to be stored, distributed, and polluted. As a reservoir and transmission medium for human disease, water has been a leading problem in environmental health through history. Cholera is reliant on water as its primary vector of transmission and food as a secondary vector. Therefore, cholera has an environmental mode of transmission. This mode of transmission can easily be seen as the subject of expanded environmental regulations to protect interests in trade, tourism, pollution prevention, and human health. Regional or local environmental regulations could increase regulatory measures on public sanitation systems for the control of all water-borne diseases like cholera.

To control cholera, environmental regulatory efforts must go beyond the actions taken by PEEM and have more enforceability than the guidance published by the WHO. Specific environmental laws that are applicable to the control of cholera, like those described in the previous Part, should be used. However, laws that promote environmental cooperation are not enough. Individual states must impose

273. See Blake, *supra* note 8, at 15.

stricter environmental water quality regulations if they are to cohesively defeat the continuing re-emergence of cholera. Treaties that specifically set water quality standards for shared water sources should be established if they are not already in existence. Entering into such agreements would follow an often accepted view that activities causing threats to the environment should be regulated by international legal rules.²⁷⁴ Hence, actions taken by states that cause cholera contamination of water sources threaten the environment and merit regulation by international mechanisms.

Another advantage to the establishment of agreements is that they often ensure a level of due diligence among states. A higher level of water quality standards could be imposed globally giving rise to states' expectations that the obligations thus created would be respected. Therefore, creating international agreements for drinking water or sanitation may have a greater success of preventing cholera, because states would then feel obligated by due diligence to uphold their agreement.

C. Efforts to Improve Environmental Protection to Aid in Cholera Control

1. Sanitation

Cholera is a preventable disease. If sanitary measures are taken to improve environmental conditions, the threat of cholera largely dissipates. Cholera can be reliably prevented by ensuring that all populations have access to safe drinking water, enough water to practice good hygiene, and adequate sanitation systems. Unfortunately, these features are distant goals for many countries with endemic cholera, and both poverty and illiteracy constitute significant barriers to improvement. For much of the world's population, adequate sewage treatment plants are not currently affordable nor will they likely be in the future.²⁷⁵ Upgrading existing sewage disposal systems for some states is beyond their economic capabilities, so many cities have not kept pace with their growing populations, and, thus, provide inadequate sewage disposal. The WHO has taken these facts into account, and has proposed methods of sanitation that are inexpensive yet still effective to prevent cholera epidemics. Among these methods are boiling drinking water vigorously, making water safe by chlorination, and teaching the importance of hand washing with soap or ash after any contact with excreta.²⁷⁶

Chlorination is one of the best weapons against cholera. The WHO reports that over nine million people die because their water is not chlorinated.²⁷⁷ Such a

274. See NOLLKAEMPER, *supra* note 183, at 210.

275. See RUSSELL F. WHALEY & TALAL J. HASHIM, *A TEXTBOOK OF WORLD HEALTH: A PRACTICAL GUIDE TO GLOBAL HEALTH CARE* 235 (1995).

276. See *Guidelines for Cholera Control*, *supra* note 116, §§ 3.1-3 (discussing different techniques in preventing cholera transmission).

277. See Kenneth Smith, *The Media's War on Essential Chemicals: Targeting Chlorine*, 6:2 *PRIORITIES* 6, 8 (1994); Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 53 *WASH. & LEE L. REV.* 851, 883 (1996).

statistic is not surprising considering that, during the 1980s, 1.8 billion people lacked access to clean drinking water and 1.7 billion lacked access to adequate sanitation services. Despite efforts to supply new drinking water sources and sanitation services, these numbers have not decreased.²⁷⁸ Not all the deaths mentioned above are cholera related; however, some have suggested that thousands who died during the cholera outbreak in Peru could have been saved had the Peruvian government ensured that their country's drinking water was chlorinated.²⁷⁹

Furthermore, the pursuit to sustain high quality drinking water at minimum economic expense is ongoing. Researchers have developed low-cost, relatively simple procedures to create an environment with safe drinking water. The Center for Disease Control is now promoting one cheap and effective technique: "bucket-lids" and a "table-top purification system" using table salt.²⁸⁰ The technique requires a simple water purification system in which table salt is separated into chlorine and sodium with electrodes, using local power lines, solar panels, or car batteries to run small power generators. The new extracted chlorine, then, is put into local drinking-water sources.²⁸¹ This technique not only meets the WHO standards, but also is estimated to cost only fifteen cents per month per family of five.²⁸²

Implementation of new technologies cannot be imposed on states unless these technologies are somehow required by inclusion into a treaty, another international agreement, or dictated by national law. Without the force of law, new technologies have limited or no effectiveness in preventing disease. From a scientific standpoint, cholera may be preventable so long as these technologies are used; however, without the legal constraints binding states to use these practices, cholera will continue to flourish.

The current water quality standards adopted by the WHO are recommendations and are not legally binding.²⁸³ The nonlegal nature of such guidelines leaves states with too much latitude to ignore them. The solution is to adopt the WHO guidelines for water quality standards as legally binding rules. Another recommendation that will aid in the prevention of cholera is to incorporate the WHO standards for water quality and sanitation into treaties and other legally binding instruments. By doing so, states would be obligated to maintain specific sanitation practices that, in turn, would prevent cholera epidemics.

Another critical element of sanitation and drinking-water supplies is sustainability. Policy decisions and scientific developments to improve sanitation and drinking-water quality must be done with sustainability as the objective. Methods of development and improvement must be financially and operationally

278. See Pamela LeRoy, *Troubled Waters: Population and Water Scarcity*, 6 COLO. J. INT'L ENVTL. L. & POL'Y 299, 314 (1995).

279. See Susan W. Putnam & Jonathan Baert Wiener, *Seeking Safe Drinking Water*, in RISK VERSUS RISK: TRADE-OFFS IN PROTECTING HEALTH AND THE ENVIRONMENT 124, 125 (John D. Graham & Jonathan Baert Wiener eds., 1995).

280. Constance Holden, *Purification in the Time of Cholera*, 265 SCI. 476, 476 (1994).

281. See *id.*

282. See *id.*

283. See NOLLKAEMPER, *supra* note 183, at 210-11.

realistic. Personnel at both the managerial and operative levels must be adequately trained in order to ensure optimal conditions are maintained. Communities, not just public health officials, must be informed of the necessary steps to take to ensure a sustainable level of safe drinking water. Population growth projections as well as environmental conditions must be considered when designing sanitation systems. Overall, sustainability must remain a component of the policy and technical engineering for sanitation and drinking-water systems in order to ensure the public health.

2. Environmental Surveillance

Environmental surveillance offers unique opportunities to recognize the environmental conditions ripe for a cholera outbreak before the outbreak occurs. This precautionary approach to surveillance is significantly different from the traditional surveillance approach which is to only report outbreaks. Environmental surveillance can be achieved by many different procedures. One procedure already used by environmental scientists is bioindicators. Bioindicators are biological organisms such as plant life or microorganisms that are sensitive to toxins and environmental changes. Illnesses, death, or rapid growth of the bioindicator can be indicative of poor environmental health.²⁸⁴ Thus, bioindicators can be used as an early warning sign that environmental changes have occurred which might give rise to cholera outbreaks. Algae blooms can serve as bioindicators for the development of favorable conditions for cholera.²⁸⁵ By monitoring the occurrence of algae blooms, cholera can be indirectly monitored. A current method of monitoring algae blooms is by satellite imagery.²⁸⁶ Once an algae bloom is discovered by satellite imagery, it should be sampled and tested for cholera.²⁸⁷ By monitoring algae blooms by satellite imagery, environmental conditions associated with cholera can be monitored, cholera can be detected, and a potential epidemic can be avoided.

Surveillance of community sewage also would be an effective means of limiting the degree and severity of cholera outbreaks. Such an environmental surveillance would be of particular value in areas where cholera has not been confirmed but is suspected or in areas bordering regions with cholera. One suggested technique of surveillance is the use of "Moore swabs."²⁸⁸ "Moore swabs" are placed in city sewage effluents and then tested for the presence of cholera.²⁸⁹ In addition to specifically monitoring for *Vibrio cholerae*, cities with some form of public sanitation system could require a more general environmental surveillance technique. Operators of public water systems could be required to watch closely for

284. See Andrew Haines et al., *Global Health Watch: Monitoring Impacts of Environmental Change*, 342 LANCET 1464, 1466 (1993).

285. See *supra* text accompanying notes 86, 91-94.

286. See Haines et al., *supra* note 284, at 1466; Harvard Working Group, *supra* note 56, at 24-25.

287. See Haines et al., *supra* note 284, at 1467.

288. Timothy J. Barrett et al., *Use of Moore Swabs for Isolating Vibrio Cholerae from Sewage*, 11 J. CLINICAL MICROBIOLOGY 385 *passim* (1980).

289. See *id.* at 385-87.

defects that could allow contaminants to enter the water system. Environmental surveillance should not replace current surveillance procedures as established by international regulations and agreements, but instead, act as an additional method used to improve cholera control.

The WHO, as an already well recognized international organization, is ideal to play a key role in coordinating a global infectious disease watch based on environmental health initiatives. In order to effectively do so, the WHO would need to become involved in global observation systems that monitor ocean, terrestrial, and climate changes. "Existing collaborative program[s] with other UN agencies [(FAO, UNEP) will position the WHO] to promote interdisciplinary activity on climate and ecosystem health" that would, in turn, clearly benefit human health.²⁹⁰

3. Application of the Precautionary Principle

Few principles are better established in the philosophy of environmental law than the precautionary principle. The precautionary principle is based on the ideal that governments have a duty to "take precautions to protect public health and the environment, even in the absence of clear evidence of harm and notwithstanding the costs of such action."²⁹¹ The principle requires reduction and prevention of environmental and health impacts irrespective of the existence of risks. Action is required, under the precautionary principle, even if risks are not yet certain but only probably, or even possible.²⁹² The crucial point is to prevent or reduce the risk of environmental harm. The precautionary principle does not weigh economic analysis and scientific proof as much as might be expected. Instead, the precautionary principle emphasizes: (1) the vulnerability of the environment; (2) the limitations of environmental science to accurately predict threats and formulate preventative measures; (3) the availability of alternatives; and (4) the need for long-term comprehensive economic considerations that include environmental degradation and the costs of waste treatment as factors.²⁹³

With the growing international concern for the environment, the precautionary principle is rapidly assuming a central role in international environmental protection. The 1992 Rio Declaration of the U.N. Conference on the Environment explicitly declared that "[i]n order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities."²⁹⁴ Utilization of the precautionary principle has been extended by international

290. Haines et al., *supra* note 284, at 1469.

291. Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 53 WASH. & LEE L. REV. 851, 851 (1996).

292. See Lothar Gündling, *The Status in International Law of the Principle of Precautionary Action*, 5 INT'L J. ESTUARIES & COASTAL L. 23, 26 (1990).

293. See Ellen Hey, *The Precautionary Concept in Environmental Policy and Law: Institutionalizing Caution*, 4 GEO. INT'L ENVTL. L. REV. 303, 308 (1992).

294. *Rio Declaration on Environment and Development*, *supra* note 210, princ. 15, at 4.

delegates to aid in confronting the issues of climate change and sustainable development.²⁹⁵

Increased prevalence of the precautionary principle in international environmental law suggests a shift in lawmaking approaches from responsive to preventative. This shift in international environmental law to focus on risk aversion has a twofold impact on the control of infectious diseases such as cholera. First, by taking a precautionary approach to prohibiting environmental degradation and pollution, indirect improvements to infectious disease control are made. Enhanced proactive protection of the environment will eliminate conditions that are predisposed to disease outbreaks. By virtue of protecting the environment, public health has been protected. Finally, with environmental protection regulations already in place, public health costs can be reduced. Preventative health measures often produce less cost than necessary response measures, and in the case of cholera, lives are saved and illness avoided by having already ensured environmental protection of water. Second, the precautionary approach can be directly applied to the control of cholera. Precautionary measures can be taken, as they have been for the environment, for the prevention of cholera. Sanitation, itself, is a precautionary measure. Ensuring availability of safe drinking water and the establishment of waste treatment facilities prevents cholera outbreaks.²⁹⁶ Therefore, it is important to re-emphasize the need for the worldwide implementation of sanitation measures as a cholera precautionary action.

Local measures based on the precautionary principle also can be taken to fight cholera. These may include local regulations that require chlorinated drinking water and regular testing of water sources for cholera. In addition, if national and local governments have not already done so, precautionary food protection measures should be imposed to mandate proper food handling. It is without argument that some of these preventative actions have been attempted to control cholera, yet they have failed. Perhaps they have failed because of either delayed implementation or a lack of enforcement capabilities. Nevertheless, what is certain is that the precautionary approach has significant utility in the control of cholera. The precautionary principle can be incorporated into multilateral or bilateral agreements for the control of cholera. It can also serve as an underlying principle in international organizations' policies, action plans, and guidelines. Irrespective of the way it is used, the precautionary principle should be used as another means to control cholera.

The precautionary principle is not without its critics. One commentator asserts that the precautionary principle's implication "is profoundly damaging to science and society: Scientific uncertainty, rather than the normal verified hypotheses of

295. See Gregory D. Fullem, *The Precautionary Principle: Environmental Protection in the Face of Scientific Uncertainty*, 31 WILLAMETTE L. REV. 495, 504 (1995) (finding that "[i]nternational delegates confronting the issue of global warming have also embraced the precautionary approach"); Richard B. Howarth, *Sustainability Under Uncertainty: A Deontological Approach*, 71 LAND ECON. 417, 420-25 (1995) (defending the precautionary principle, both philosophically and through economic modeling).

296. See *Guidelines for Cholera Control*, *supra* note 116, § 3.1.

cause and effect, becomes the basis for policy. The subjunctive becomes governmental imperative."²⁹⁷ Another critic claims that the precautionary principle replaces environmental risk with risk to wealth of a country.²⁹⁸

Despite criticisms, the precautionary principle has gained notable recognition as a guiding doctrine in international environmental law, yet its applicability is not limited to the environment. It encourages the best of all measures to take in the face of potential harm prevention. Therefore, its utility to the control of cholera may prove to be indispensable. The precautionary approach coupled with enhanced international cooperation may very well render the threat of cholera immaterial.

D. Application of Global Health Jurisprudence

A final recommendation is to apply the newly developed concept of *global health jurisprudence* to the control of cholera.²⁹⁹ This concept developed from the recognition that international law alone cannot ensure global health, but rather global health will only be achieved by encompassing both international and national law as applied to public health issues.³⁰⁰ It is naive to believe that international law will provide the solution to all global health problems without the accompaniment of improved national systems.³⁰¹

Global health jurisprudence puts into practice what may already be evident: international and national law are interdependent. Reform of international law often reflects the legal trends and developments that have occurred at the national level, and reform of national public health law is often dependent on legal activity at the international level.³⁰² This interwoven relationship between international and national public health law is the critical element, recognized by global health jurisprudence, that can and should be utilized to improve the effectiveness of the international control of cholera.

In order to conceptualize the application of global health jurisprudence to the control of cholera, it must be clearly defined. Global health jurisprudence is the "body of rules, strategies, and procedures that allows law in all its forms to support public health."³⁰³ The goal it sets forth seems to have two components: (1) to identify approaches, concepts, and standards that emanate from various sources of international and national law, and (2) to foster discourse among states of these identified approaches, concepts, and standards in order to establish the necessary

297. Patrick Michaels, *Environmental Rules Should Be Based on Science*, INSIGHT ON THE NEWS, Apr. 12, 1993, at 21, 21.

298. See F. Sherwood Rowland, *Failure at the Earth Summit*, 256 SCI. 1101, 1109 (1992).

299. See David P. Fidler, *The Future of the World Health Organization: What Role for International Law?*, 31 VAND. J. TRANSNAT'L L. 1079, 1116 (1998).

300. See *id.* at 1116-17.

301. See Ian Brownlie, *The Expansion of International Society: The Consequences for the Law of Nations*, in THE EXPANSION OF INTERNATIONAL SOCIETY 357, 368 (Hedley Bull & Adam Watson eds., 1984).

302. See Fidler, *supra* note 299, at 1116-17.

303. *Id.* at 1117.

legal mechanisms to address global health issues.³⁰⁴ In addition to lawmaking, global health jurisprudence also plays a role in international policymaking.³⁰⁵

With the application of global health jurisprudence to the control of infectious diseases, cholera outbreaks likely would be less frequent and possibly less severe. Global health jurisprudence will establish a better international framework to regulate public health issues generally, as well as provide a system in which already existing national laws, regulations, and strategies, that have proven to be effective in preventing cholera, can be applied globally. For example, under global health jurisprudence, public health measures utilized by the EC to prevent cholera could be applied on an international scale or at least extended to developing countries. Global health jurisprudence establishes not only vertical relationships among international organizations and states, but also horizontal relationships between international organizations and between states.³⁰⁶ This bi-directional foundation of relationships greatly improves the potential for effective international cooperation, communication, and regulation of cholera.

Global health jurisprudence is a fairly new concept, and as any new legal tool it will evolve and be refined with use. Therefore, it is much too early to critique its success or failures. Until global health jurisprudence is applied to the global control of infectious diseases, specifically cholera, its potential success in controlling disease spread and eliminating disease occurrence remains somewhat uncertain. Nevertheless, global health jurisprudence is a refreshing new legal concept applicable to international infectious disease control, and perhaps exemplifies the direction international infectious disease control should follow.

CONCLUSION

Cholera is a disease in resurgence that threatens the health of the global community. It is a disease that has killed thousands, taxed trade relations, scarred economies of cholera-afflicted nations, and thrived on environmental degradation. Vaccines against cholera prove ineffective, and susceptibility to cholera infection is remarkably high once cholera has contaminated drinking-water sources. Furthermore, the modern scale of global commerce and travel makes a cholera outbreak a threat to virtually every nation.³⁰⁷

In evaluating the factors that contribute to its spread and the current regulatory regime for infectious diseases, it becomes evident that to prevent cholera, states and international organizations must take a proactive, cooperative approach. Environmental, social, and economic factors that allow for cholera outbreaks must be addressed and globally coordinated responses must be initiated. Apparently, a grave mistake that nations made in the past in their attempts to regulate cholera was

304. *See id.*

305. *See id.* at 1118-22 (discussing the policy-making role of global health jurisprudence and the current debate by policy experts and legal scholars).

306. *See id.* at 1118-21.

307. *See Fidler, supra* note 5, at 794-800 (citing the globalization problem in combating the spread of infectious diseases).

to overlook the importance of the environmental factors. At the core of cholera epidemics lies poor sanitation and inadequate drinking water. Controlling these environmental factors is the key to defeating the cholera epidemic.

The environment in which people live is an important factor in the realization of human health. Human societies both modify, and are modified by, their physical surroundings. Human health is affected by those modifications. Globally, the environment is experiencing deterioration at an alarming rate and human health is placed in a parallel peril. Cholera is a clear example of the detrimental effects that environmental degradation can have on human health. Cholera re-emerges when water resources are polluted by human waste or wastes that contribute to algae blooms. With an increase in the number and geographic range of algae blooms, cholera outbreaks can be expected to increase. In sum, cholera teaches a broad lesson: if humans do not care for their environment, then they will not be able to adequately protect themselves from infectious diseases.

